November 1980
US $2.50 CAN $3

80 microcomputing™

the magazine for TRS-80 users*

Get Wired!

Micro networks are changing the way we communicate. Will they change the way we think? Page 62

Inside: Tandy's Pocket Computer puts BASIC in the palm of your hand. Page 125

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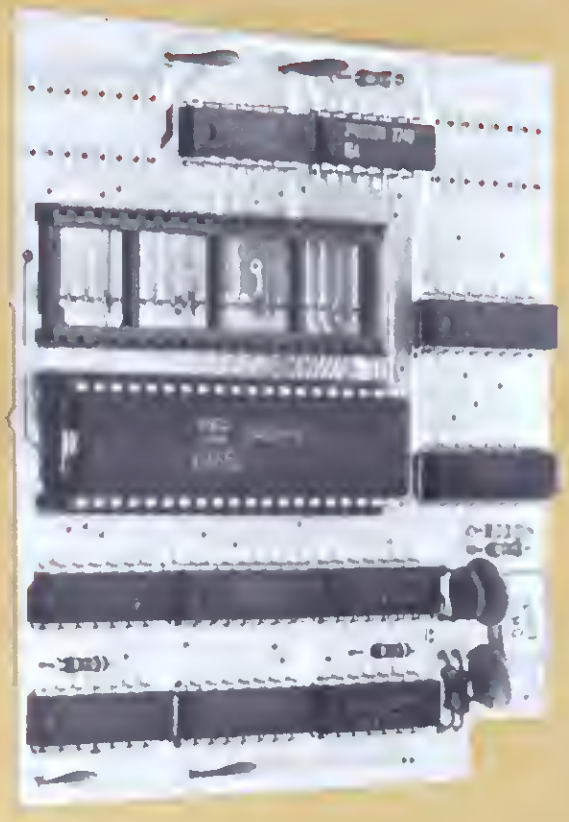
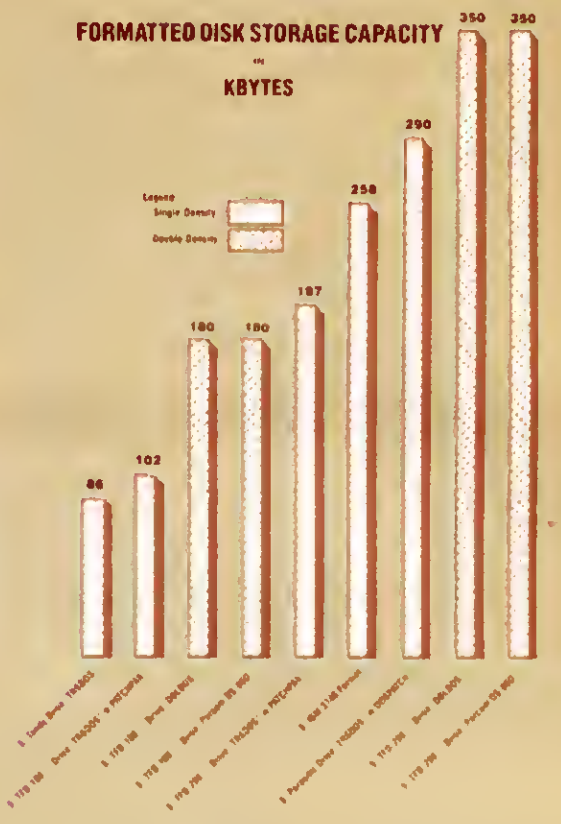
TRS-80* Model I Computer Owners . . .

Store Up to 350 Kbytes on a 5″ Disk





The DOUBLER™. It packs almost twice the data on a disk track as your single-density system. Depending on the type of drive, you can store up to **four** times more data on one side of a minidiskette than you can store using a standard Model I mini-disk drive.

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- Includes DBLDOS™, a **TRSDOS* compatible** double-density disk operating system.
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the DOUBLER™ — This proprietary adapter for the TRS-80* Model I computer packs approximately twice the data on a disk track

Depending on the type of drive, you can store up to four times as much data — 350 Kbytes — on one side of a minidiskette as you can store using a Tandy standard Model I computer drive.

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And because the DOUBLER reads, writes and formats *either* single- or double-density disks, you can continue to run all of your single-density software, then switch to double-density operation at any convenient time.

Included with the PC card adapter is a TRSDOS*-compatible double-density disk operating system, called DBLDOS™, plus a CONVERT utility that converts files and programs from single- to double-density or double- to single-density format.

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Note: Opening the Expansion Interface to install the DOUBLER may void Tandy's limited 90-day warranty.

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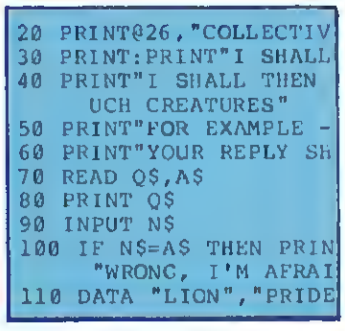
When the postman rings in the future, he may not. That's the thrust of this feature on the future of electronic mail and data processing via the phone lines. Can the micro replace the telephone?



```
20 PRINT@26,"COLLECTIV
30 PRINT:PRINT"I SHALL
40 PRINT"I SHALL THEN
     UCH CREATURES"
50 PRINT"FOR EXAMPLE -
60 PRINT"YOUR REPLY SH
70 READ Q$,A$
80 PRINT Q$
90 INPUT N$
100 IF N$=A$ THEN PRIN
     "WRONG, I'M AFRAI
110 DATA "LION","PRIDE
```

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by I. R. Sinclair

In part III of this introductory course, Ian Sinclair explores some of the most powerful commands in BASIC—IF . . . THEN . . . ELSE statements. Examples are easy to follow: herds of cows, gaggles of geese and flocks of sheep.

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Keep your 80 in the dark with this complete photography program. Step-by-step, you'll mix your chemicals and track your development time.

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by Ken Knecht

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by Buzz Gorsky

Here's a nifty program: a pattern drawer that no doubt has a thousand applications. The author dares you to name just one.

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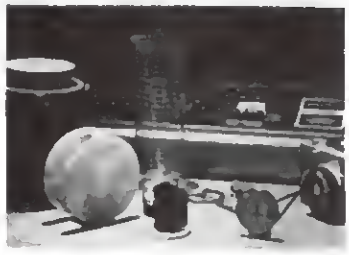

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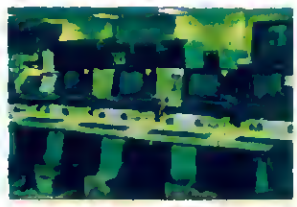

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  - RESTORE FIELD contents
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  - SKIP RECORD (to next or previous record)
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  - 200 RECORDS (40 characters) in about 5 SECONDS
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- Prints user-specified fields in titled, columnar REPORT FORMAT, automatically generating column headings, paging and (optionally) indentation
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BELOW ARE TESTIMONIALS from owners of AIDS systems. These are absolutely authentic statements and are typical of the comments we receive.

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Jack Bilinski, President, 80 Microcomputer Services

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*WARNING: This program is written in BASIC and can be listed in the normal manner. Modification of program code is NOT RECOMMENDED due to its extreme complexity.

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MTC AIDS-II . . . . . $ 49.95
For Model II . . . . . $ 79.95

WE GOOFED!

For customer appreciation month in September, MTC offered VERBATIM 5¼" diskettes for $19.80 per box. As part of limiting this offer to one box per customer, we required the inclusion of the actual ad page with each order. While there was a significant response to our offer, a number of individuals expressed considerable irritation at having to deface their magazines. This month heralds the introduction of Meta Tech's PLAIN JANET™ diskettes, The Beautiful Floppy with the Magnetic Personality™. To better promote this fine product and to apologize for any inconvenience or irritation we may have caused, we are offering PLAIN JANET™ diskettes for $19.80 per box through November 30, 1980. Thank you for your understanding and patience.

MORE PRODUCTS →

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ASSEMBLY LANGUAGE

REMSOFT's unique package, "INTRODUCTION TO TRS-80® ASSEMBLY PROGRAMMING" includes ten 45-minute lessons on audio cassettes, a display program for each lesson providing illustration & reinforcement, and a text book on TRS-80® Assembly Language Programming. Includes useful routines to access keyboard, video, printer and ROM. Requires 16K - Level II, Model I.

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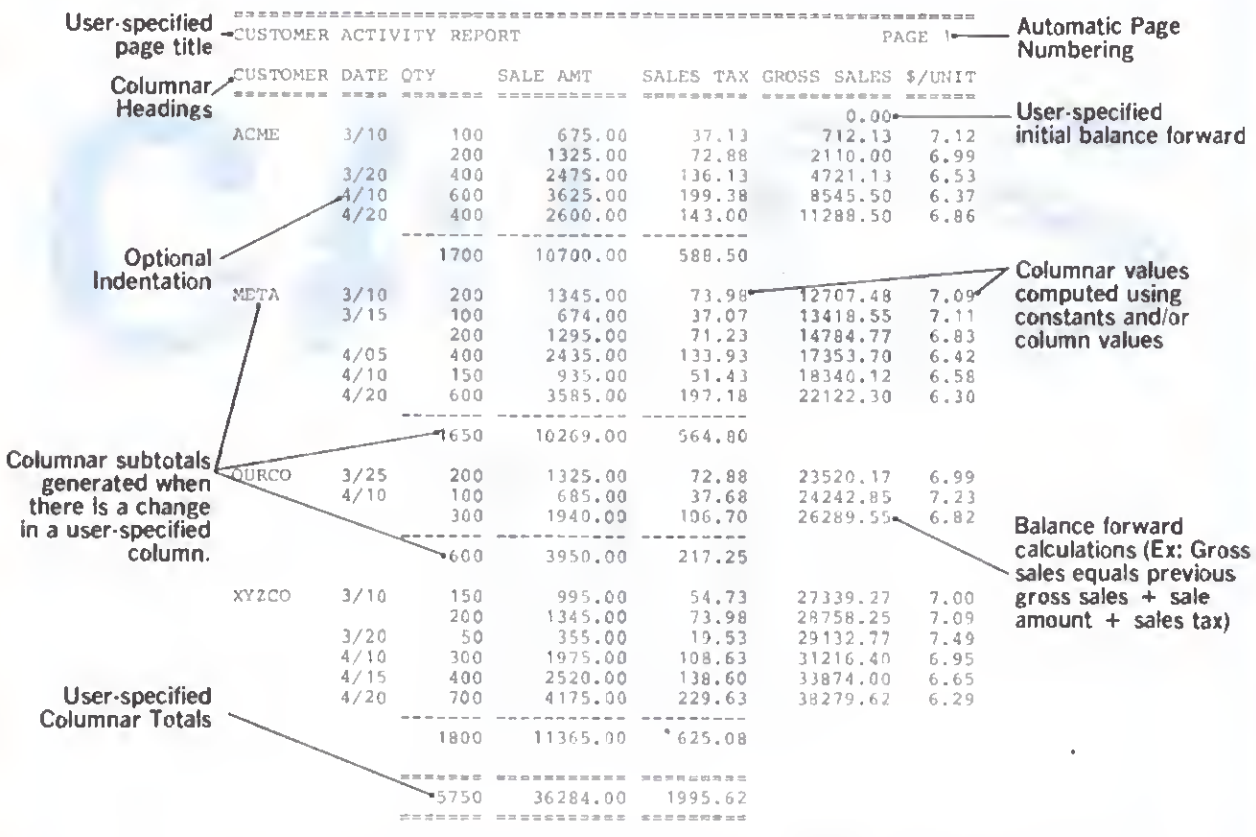

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✓ Reader Service—see page 242

80 REMARKS
by Wayne Green

"...the kit was just the start...it was much like buying a car and finding out that the motor is an extra ...and the wheels."

The Mits Debacle

A recent letter from an ex-Mits employee confirms what I've heard from many sources—from Ed Roberts himself. I thought you might like the inside information.

The first microcomputer of significance, the Altair 8800, was brought out by a virtually bankrupt firm in Albuquerque, NM. They had been making hand calculators, until low cost calculators from TI and others nearly put them under. In the nick of time the president, Ed Roberts, a computer hobbyist, put an 8080 microcomputer kit on the market selling for under $400. Of course, what most of the first kit buyers didn't know was that the kit was just the start...It was much like buying a car and finding out that the motor is an extra... and the wheels.

Despite that and other major problems, Mits soon became a very large company, selling over $5 million in kits in the first year, 1975. In the summer of 1976 Roberts sold the firm to Pertec, a manufacturer of disk drives. Then Pertec began a series of ridiculous business decisions which took Mits from its IBM position in the microcomputer field to a total unknown.

Pertec had a golden opportunity to build Mits into a billion dollar corporation, but by incredibly poor business decisions —fought every inch of the way by loyal Mits employees and management—they destroyed the firm. First, they stopped development on the Z-80 based CPU. Next, they spurned the hobbyist market which fed the growth of the entire field. Then, they forced dealers to handle only Altair equipment; this lost most of their good dealers. As a small business machine it was terrible because they were unable to provide significant software.

Pertec was eventually bought out by Triumph-Adler, a subsidiary of Volkswagen. The sales of their new system, no longer even S-100 compatible, fell flat and a large portion of their employees were laid off in Albuquerque. Many of the original Mits people left the firm in disgust.

There is so little left by now that if Triumph-Adler wanted to get back into the microcomputer business via Pertec and Mits it would be almost prohibitive. It is really sad to see so many millions of dollars wasted...and the opportunity for making billions squandered.

Tandy Expo

The Radio Shack dealers have been organizing TRS-80 blitzes in major cities. Not long ago they descended on Boston

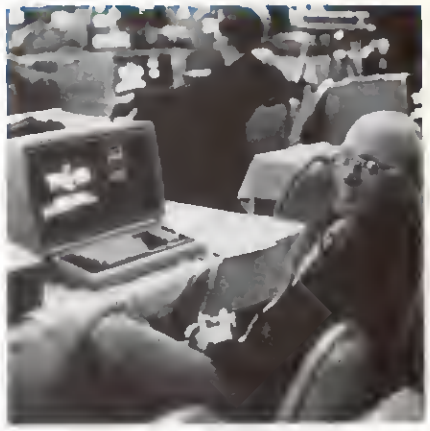

Photo 3. Chuck Martin of Tufts Electronics was sold on a Model II.

and made quite an impression.

Most of the systems set up for the demonstration were Model II, but they did have one row of Model I systems (on the right). The place was packed. They started out with a film showing how Radio Shack got involved with computers.

In order to get the beginners interested, Tandy started out with all the systems being driven by one host.

After showing how simple it is to write a BASIC program, they turned the comput-

Photo 1. At Tandy's Expo, a film is shown, describing how Radio Shack first entered the computer field.

Photo 2. Tandy leads you step-by-step through a BASIC program, showing you how easy it is.

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Single Sided, Single Density, Soft-Sectored 5¼-inch, (for TRS-80™) Mini-floppy

DISKETTES

$19.80 ★ box of 10

Meta Technologies strikes again . . . at the competition! These are factory fresh, absolutely first quality (no seconds!) mini-floppies. They are complete with envelopes, labels and write-protect tabs in a shrink-wrapped box.

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↙ Reader Service—see page 242

ara loosa. Naxt they examined some useful business programs.

Chuck Martin, tha ownar of Tuft's Electronic Department Stora (in Boston) want with us to aee the damonstrations. He was convinced and ordered a Modal II. Ha is using it with the Galactic mailing list program to keep track of customers and send them catalogs.

Tuft's, by the way, is a dealar for Atari and, I believa, Apple. Ha bought three TRS-80 Modal I syatems so far and, after trying to usa them in his buainasa, sold them off. The Modal II seems to be permanent.

Tandy Listing

Radio Shack has recently come out with a 99¢ book which lists programs availabla for tha TRS-80. I viaw this as a mixed blessing. On tha ona hand it does provida tha TRS-80 owner with a list of availabla programs, as of a faw months ago. But having tasted quita a numbar of thasa programa, and our lab having tasted many mora, I would say that the chancas of a customer picking a winner from among tha listings is vary chancy. Thara are so many really terrible programs out thara. It is not a healthy situation.

The TRS-80 owner faces a softwara jungle. Let me say this... pleasa, pleasa, if you buy some softwara from any firm, writa and let us know what you think of it. Please assist us in helping everyone by naming the poor ones and giving a boost to tha good ones. Evary firm in the business has a responsibility to put out first-rata software and we'll not be satisfied until we feel we era doing avarything possibla to maka that a fact. This goes for Instant Software too. I want to hear if you get a program you don't think is first-rata.

Maanwhila, if you get that 99¢ book be vary careful about whara you spend your money.

Warning!

The matariel in this magazina is designed to be of valua to all readara, from rank novica through TRS-80 axpert.

80 Microcomputing is intanded to be a continuing encyclopedia of TRS-80 information. Thus, if some articles ara, for the moment, over your head, hava patiance ...for you'll be vary glad to hava them later, whan you era familiar anough with your TRS-80 to use them. ■

INSIDE 80

by Ed Juge, director of computer merchandising, Tandy Radio Shack

Let's talk about word processing, why and how wa did it and what wa're doing now.

One of the early assumptions mada by Radio Shack regarding the TRS-80 Model I was that small computar demand would be mostly for data processing. Considering the cost of lattar quality printars, we didn't think that word processing intarast would be significant. You told us early on that wa needed to change our thinking.

Thara wara four problems to solve bafora Modal I Scripsit could be readied for tha market:

- Coma up with a lattar quality printar at a price in lina with the cost of tha computar.
- Implamant a quality lowarcasa vidao character sat.
- Maka tha lowarcasa modificetion aasily fiald installabla, and with no holas to drill.
- Find or writa a good word procassor program.

Unfortunataly, finding a reasonably-priced printar and a program turned out to be major problams.

Wa talkad to at laast aight potantial suppliars, talling tham that we intended to retail a printer for $2,000 or less, without much success. Navarthalass, we finally achieved our goal with a naw daisy wheel printar this fall!

Tha other critical raquiramant was softwara. Wa talkad to savaral word processor authors, but it quickly became apparant that a good software program at a Radio Shack price would requira an in-housa davalopment effort.

Our design taam zaroed in on the needs of the avarage typist, purposaly omitting aoma of the mora advanced word processing faaturas—boldfaca, undarlining and automatic totals. Wa included specific faaturas, avaluated on thair usafulness to the avarage typist, on tha amount of mamory overhead and on tha time required to davalop tham. Tha raviaws that Scripsit has racaivad hava indicated that wa mada mora right dasign decisions than wrong ones.

Model II Scripsit—Altogether Different

Modal II Scripsit is a pago oriantad, manu drivan word processor. A document can be many pagas long, yat thara is no need to worry about what fits in tha cora mamory.

Tha Model II disk contains a specially modified varsion of TRSDOS. Tha opening screen is a disk directory showing tha nama, author, creation and last ravision datas, page count, percant of disk space occupiad, and other information. At the bottom of tha page is a one-lina manu giving the operator the option to opan, dalata, or craata a document—or go to a saparate disk utilities routine.

Disk utilitias includa FORMAT, BACKUP, SPOOLING on/off, changing dafault valuas for window moda, format linas, paging and print settings, user-defined keys and satting up sarial printar output paramatars. Wa've tried to do avarything alsa.

Whan you're processing taxt, you're working with ona paga at a time, so tha total documant's langth is limitad only by the disk space availabla.

The bottom scraan linas ara reserved. Tha top lina is the format line. It displays margins, tabs, etc. (You can craata up to 11 predefined format lines and stora tham for later usa, or you can craata and usa a tamporary lina without storing it.)

The bottom line is a prompt/manu line. It normally displays documant name, currant paga number, cursor position (both lina number and horizontal position), margins, atc. Information is updatad with avary charactar you typa.

You hava full cursor control, and tha usa of spacial commands is mada simpla through tha systam of manus. Oftan used faaturas ara accassad through a control kay. For axampla, "gat naxt paga," is CTRL-N. If you're a frequant usar of soma functions wa didn't anticipata, taka heart! You can dafina your own special function saquancas for CTRL-J, K, O, Y, and Z.

Just Five Kays to Ramambar!

Modal II needs no special kay labels. You need ramambar only fiva kays: F1—to insart, F2—to dalata, ESCAPE—to call tha manu or to activate a manu page instruction, BREAK—to cancal an instruction or return you to the previous moda, and HOLD followed by an arrow, homes the cursor to top, bottom, laft or right side of tha currant page.

You can insert naw copy or blocks—and avan extra pagas. You can ranumber and resequance the pagas, or rapaginata

META TECHNOLOGIES

FOR YOUR TRS-80™ DISK SYSTEM

PROGRAMMING TOOLS

TDAM $19.95
For Model II $29.95
Includes MTC QUE Card!

Having trouble with RANDOM FILES? With MTC's Table-Driven Access Method (TDAM) you'll never fret over FIELDing again. No knowledge of random access files is required. Insert the TDAM "interpreter" into any BASIC program and type in a few DATA statements describing the information in your files. TDAM does the rest! Reads and writes fields and records of any type (even compresses a DATE field into 3 bytes!). Features automatic file buffer allocation/deallocation, memory buffering, sub-record blocking/deblocking, and handles up to 255 fields per record. Super fast and super simple! Complete with TDAM interpreter, instructions and demo program. Requires programming experience.

SIFTER $19.95
For Model II $29.95

Twelve in-memory high-speed sorts for use in any BASIC program: stable, non-stable, with/without tags, for numeric or string data. Random File Sort included. Some sorts written in machine code. Includes sort subroutines, demo programs and instructions. Relocate as needed with REBUILD. Requires programming experience.

SHRINK $19.95
For Model II $29.95

Makes Every Byte Count! Make programs smaller and faster! Combines lines & removes unnecessary code including remarks, without altering program operation. Typically reduces program size 25% to 40%.

SUPERSEDE $19.95
For Model II $29.95

A "must have" for the professional programmer or the serious amateur. Probably one of the greatest time-savers available. Write programs in shorthand - change variable names - generate program documentation - use with REBUILD and MINGLE to build new programs from old ones.

MINGLE-II $19.95
For Model II $29.95

Merge up to 14 files (Program or Data) into a single file. Data files may be merged in ascending or descending sequence with the ordering based on a user-specified comparison field. A very handy utility for consolidating data files

"OTHER MYSTERIES" VOLUME II

foreword by
H.C. PENNINGTON

Call now and place your order for this new book, "MICROSOFT™ BASIC DECODED & OTHER MYSTERIES for the TRS-80™", from IJG, Inc. A primer for cassette and disk BASIC on the TRS-80™, the information provided applies to similar MICROSOFT™ BASIC interpreters. Features include definition of terms, an overview of BASIC and DOS, explanation of exits, error codes, verb actions, "cold" and "warm" restart procedures and examination of system utilities, arithmetic support and I/O driver routines, and the communications region in RAM. Individual routines are explained in detail, with an index provided for easy access. Appendixes include tables for BASIC and DOS vectors, stacks and interrupt locations, PLUS thousands of comment lines for the complete MICROSOFT™ BASIC

MICROSOFT™ BASIC DECODED $29.95

The perfect supplement for your NEWDOS, from IJG, Inc.

"TRS-80™ DISK AND OTHER MYSTERIES"

by Harvard C. Pennington

132 pages written in PLAIN ENGLISH packed with HOW TO information with details, examples and in-depth explanations. Recover lost files and directories, remove file protection, make BASIC programs unlistable. How to use SUPERZAP, recover from DOS errors and MORE!

TRS-80™ DISK $19.95

NEWDOS/80

by Apparat

Apparat's long-awaited successor to NEWDOS+ is here! This is not an enhanced version of NEWDOS, but a completely new product. Simplified DOS commands can be instantly executed from BASIC, even within a program, without disturbing the resident code. System options, such as password protection, number and type of disk drives, BREAK key enable/disable and lowercase modification recognition, can be quickly and easily changed. Five new random-accesa file types allow record lengths of up to 4096 bytes, and no FIELDing! A powerful CHAIN facility allows keyboard INPUTs to be read from a disk file. An improved RENUMBER facility permits groups of statements to be relocated within program code. Diskettes may even be designated as RUN-ONLY! Features all NEWDOS+ utilities (SUPERZAP 3.0, etc.) and much more! One MTC technical staff member said having NEWDOS/80 is "better than sex" (you'll have to judge for yourself!). Includes 180-page instruction manual and MTC QUE card.

NEWDOS/80 ..... $ 149.95

MTC QUE Card only $7.50

CALL REGARDING OUR NEWDOS+ UPGRADE PRICING.

Complete for Model I with all utilities Plus exclusive MTC QUE card!

NEWDOS + $69.95

by Apparat

Includes REF, RENUM, SUPERZAP, EDITOR/ASSEM., DISASSEM., DIRCHECK, and more! This is the original NEWDOS with all of Apparat's utility programs. Includes exclusive MTC QUE (Quick User Education) card.

MTC QUE Card only $1.50

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✓ Reader Service—see page 242

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the entire document.

More features of Model II include bold print, centering, interection with our Profile II software, justification, merging files, password protection on files, text reformatting, global search and replace, vertical or horizontal pege formats, serial printer interface block moves or duplication, and user definable defaults for display.

New Low-cost Daisy Wheel Printer

I have mentioned our daisy wheel printer. Actually, it's called Daisy Wheel Printer II. Some of you (and us) remain painfully aware that the DWP I was a fiasco. The product wes good, but serious parts and production problems existed which were not cured in time to do eny good.

Daisy Wheel II is a 43-charecter per second, 28-pound powerhouse, which accepts paper up to 16-1/2 inches wide, and makes up to six copies. Teke a tip, though, and put it on a separate stand; its fast speed and light weight cause a lot of bouncing around during printing.

DW II underlines and prints boldface when used with the Model II Scripsit. Daisy wheels with a forty-million character life are available in Courier 10-pitch, Prestige Elite 12-pitch, and Madeleine proportional spacing. The carbon ribbon cartridge is good for 200,000 characters. An optional forms tractor is also available.

A unit styled to match your TRS-80, DW II at $1,960 includes our standard parallel printer interfece connection. A separate cable is required to match your TRS-80.

Those Missing Newsletters

There is one question we get with alarming frequency from customers who ere justifiably upset: "Why won't you put me on your mailing list for the monthly newsletter?"

I've answered in print many times, but for those who don't know the answer, here it is again:

Our newsletter meiling list is made up of names and addresses sent in by TRS-80 owners on cards we include with every system. *The newsletter is available only to TRS-80 owners.* In lieu of the card, we put anyone on the list who sends in a letter with proof of ownership—serial numbers of the equipment, etc. Those who do not return the card or send a letter are *not* put on the list.

Some months ago, we mailed a questionnelre to a random sample of about 2,000 people on the newsletter list. A large number wrote back complaining that we could ask for their help, but had steadfastly refused to send them newsletters.

I was personally involved in looking up 50 of these people. Each person was on the list—correctly! The only difference we found was that the newsletter goes out third class, and the questionnaire was mailed first class. Ever since, we've been trying to determine what is causing many TRS-80 owners to miss their newsletter deliveries.

Every phase of newsletter distribution that we can control is being watched closely, end procedures improved. Once the newsletters are in the post office they're out of our hands. Rest essured, we won't give up; please bear with us just a bit longer. And thanks especially to those of you who have maintained your sense of humor through this. ■

EDUCATION 80

by Earl R. Savage

It is ell but impossible to operate a multipurpose system without a cassette recorder. It's an integral part of your computer system, even if you have a disk drive. Sooner or later you will be in the market for one.

Maybe your original recorder has broken down or worn out. Maybe you need e second machine just to use with your expansion interface. Then, of course, the most efficient wey to make back-up copies of your programs is to use two recorders and some kind of pulse re-shaper. (See TCOPY, *80 Microcomputing*, July 1980, p. 160.)

You can go back to Radio Shack for a replacement, but you should know that there are options.

Nothing Special

There seems to be nothing about the TRS-80 cassette recorder that sets it apart. Look around. You may have one around the house that will do the job.

Careful now! I don't mean that you can use any recorder. There are two characteristics the recorder *must* have. First, it must be of a certain quality. You can judge this by playing a pre-recorded music cassette. If the music sounds good, the recorder is probably sufficient.

The second requirement is a low current on/off remote control. If the current is too high, the relay in the 80 will be damaged.

I don't know what the maximum current for the relay contacts is. The CTR-80, however, draws 100 milliamps. Any recorder will be safe if it does not exceed that figure.

How can you know the remote switch current of your recorder? You may find the rating in the shop manual or, perhaps, in the owner's manual. It is easy to determine the current for any recorder with a milliammeter, VOM or similar instrument. Connect the meter, or measuring device as shown in Fig. 1, and then put the recorder in the play position.

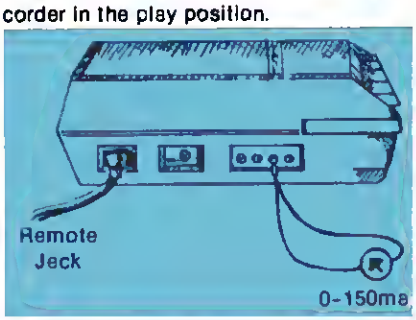

Fig. 1. Measuring Remote On/Off Current

Consider some other useful recorder features, especially if you ere buying one.

ALC (Automatic Level Control) or AGC (Automatic Gain Control), are internal circuits which electronically adjust the recording level automatically. ALC makes sure that your CSAVEd programs are always at the same level (which surely helps when CLOADing).

To determine if an unmarked machine has this feature, record a soft sound and a loud one without changing the volume control. If both sounds play back at the same volume, you have ALC/AGC.

Another desirable feature is a high-level input. Using a recorder without this requires you to feed your programs through an attenuating network (resistors) into the microphone input jack. Usually the high-level input feature is marked AUXILIARY or AUX.

You will find these additional features useful: a tape counter, rewind and fast forward controls that operate when the remote switch is off, and a monitor switch enabling you to hear the signal when CSAVEing and/or CLOADing.

If you are getting a second machine instead of a replacement, you should consider a cassette player (one which does not record). Players cost less than recorder/players. There is no reason to have two

YOUR MODEL II CAN HAVE SNAPP!

SNAPP II EXTENDED BASIC
A family of enhancements to the Model II BASIC interpreter. Part of the package originated with the best of APPAGAT, INC.'s thoughts in implementing NEWDOS BASIC. The system is written entirely in machine language for SUPER FAST execution. The extensions are fully integrated into Model II BASIC and require NO user memory, and NO user disk space. The package is made up of the following five modules, each of which may be purchased separately:

XBASIC - Six single keystroke commands to list the first, last, previous, next, or current program line, or to edit the current line. Ten single character abbreviations for frequently used commands: AUTO, CLS, DELETE, EDIT, KILL, LIST, MERGE, NEW, RLIST, and SYSTEM. $25

XREF - A powerful cross-reference facility with output to display and/or printer. Trace a variable through the code. Determine easily if a variable is in use. $40

XDUMP - Permits the programmer to display and/or print the value of any or all program variables. Identifies the variable type for all variables. Each element of any array is listed separately. $40

XRENUM - An enhanced program line renumbering facility which allows specification of an upper limit of the block of lines to be renumbered. Supports relocation of renumbered blocks of code, and supports duplication of blocks of code. $40

XFIND - Permits quick and easy location of specified strings or keywords within the program text. $30

SAVE - on the purchase of the entire package. $140

CONVERT
This remarkable utility converts "A" format files (the sequential format used by the SHACKS CODAL and DASIC Compilers) to the "I" format files (the sequential file format used by the DASIC interpreter and DASCOM), and vice versa. Without this product, programs written for the interpreter will have to be RE-KEYED to be used by the SHACKS Compiler DASIC. $75.00

SKRUNCH
A SUPER FAST TRSDOS UTILITY. Compresses your BASIC programs to an absolute minimum. Typically saves 30-40% space, even for programs without REM statements! Also results in 7-10% improvement in execution speed. $39

SBASIC — Model I and Model II
Program in a high-level, full structured DASIC! The REST of the BASIC pre-processor. PERFORM numbered subroutines. CONDITIONAL case structures. WHILE loops. UNTIL loops. And much more. Forget about line numbers. Model II version is compiled, and SUPER FAST. From Ultimate Computer Systems! Model I $50 Model II $75

DOSFIX
A collection of patches to TRSDOS and DASIC to enhance their usability and function. Includes our well-known BREAK?? patches to keep the break key from being used accidentally. FREE WITH ANY MODEL II SOFTWARE PACKAGE.

FRIEND
FOUR NEW TRSDOS COMMANDS!
SHOW — A much better multi-disk directory display. Lets you see only those files you want, and includes date of last update.
MOVE - A much better file copying command. Copy/Move whole groups of files, renaming them, in the same pass, if desired, with just 1 command!
LRASE - Better than KILL, better than /PURGE.
PRINT - Print DASIC programs from disk, whether saved in ASCII or compressed.
All 4 DOS commands allow fast processing of one, or complete groups of files, based on generic naming and wild card specifications. Enhanced functions too numerous to fully describe here.
EXAMPLES
SHOW :FAY*/DAS*
Directory display of all /DAS files on all diskettes which begin with FAY.
MOVE FAY*/DAS:1 TO */OLD:3
Save current versions of payroll programs to drive 3, changing extensions to /OLD.
MOVE *OLD*/* TO NEW */*:1
Copy all files on drive 0 which begin with "OLD", regardless of extension, to drive 1, changing the first 3 letters of the filename to "NEW" (but retaining their same file extension. Save time!
Reduce frustration!
Eliminate ERROR 39! $75

HOSTII / TERMII
Allows remote control of a Model II from another Model II, or any ASCII terminal. If terminal is a Model II, cursor screen positioning (PRINT @) is fully supported! Requires NO user memory! This system is designed to provide software support to our customer locations without ever leaving the office. $50

BUGZAP
A powerful utility oriented toward the machine language programmer. Display/Modify/Print/Memory/Disk sectors. Use this to help you learn more about the internals of the Model II. $50

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1 - 800 - 543-4628

Most products will soon be available for the Model I. CALL FOR DETAILS!

MASTER / SLAVE
This software package was designed to support the transferring of files from one Model II to another, via direct connection or modem/phone line connection. ALL kinds of files, and baud rates up to 9600 are fully supported. Transfer files in either direction, even with the SLAVE Model II UNATTENDED! $150

SPOOLER — Model I and Model II
Our workhorse! This package, available for Model I in the TRSDOS/NEWDOS or NEWDOS 80 versions, or for the Model II, greatly enhances system performance when running typical business applications. Many applications have been benchmarked to run nearly TWICE AS FAST with the SPOOLER installed. Installs in minutes, and no changes are required to your programs. Preferred Model II versions require RIO user memory. Optional features for the Model II version only: Serial printer support and DISK SPOOLING support. The DISK SPOOLING support is particularly recommended for word processing applications.
Model I $100
Model II $100
SERIAL PRINTER OPTION $50
DISK SPOOLING OPTION $50

ROUTE
Causes LPRINT data to be sent to the video screen! A great help in writing and debugging programs when no printer is available, you have a slow printer, or you are just in a hurry. Can be turned on and off from within your DASIC program. Requires NO user memory. $25

SCREEN
Supports the copying of the full video screen to the printer. Can be invoked by the operator with a keystroke, or from your program with a USR call. Requires NO user memory. $25

SAVE
Retrieve the resident DASIC program following an accidental SYSTEM, or a system crash. DON'T BE WITHOUT THIS ONE. YOU NEVER KNOW WHEN YOU WILL NEED IT! $35

TERMS OF SALE:
Credit card customers add 3%. C.O.D. customers add $3. Ohio residents add 4½% sales tax. Shipments normally made the same day we receive your order.

OUR GUARANTEE:
If your diskette arrives damaged, we will replace it without charge. If you ever accidentally damage it, we will replace it for a $10 handling charge. For a period of one year, we will provide you with any enhancements or updates for a $10 handling charge. For a period of one year, if errors are discovered in the program, they will be corrected without charge. In the event we cannot correct an error, you may return the program material for a refund.

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NEWDOS and NEWDOS/80 are trademarks of Apparat Inc.

recorders except for interchangeability in case trouble develops with one of them.

In an emergency, if you break down just when you must CLOAD or CSAVE a program with no time to measure remote switch current, use whatever machine you can locate. To avoid the chance of damaging your relay, leave the remote plug unconnected and do the starting and stopping manually.

When you have trouble with you recorder, don't immediately throw it out. Remember: *No cassette recorder/player will function if it lacks the proper care!*

Care and Feeding of Recorders

The typical audio cassette recorder/player will take a lot of abuse and still perform its designed function to deliver speeches and good music. After all, our ears are rather forgiving of its small errors.

Our 80s, however, forgive very little. Its audio machine is asked to do a critical job and the 80 expects its digital signals to be very close to the mark. Consequently, the recorder must be kept in top shape.

Most loading problems are caused by dirty recorders.

This is especially true in schools where folks use them in audio service and seldom clean them until they quit. In micro service, recorders must be cleaned regularly.

There are two phases to the cleaning process: magnetic and physical.

First, the physical cleaning.

You can buy a cleaning kit from your local electronics/audio store, but I prefer to get my supplies from the discount drug store. You will need some sticks with cotton-padded ends and some denatured alcohol. Do *not* attempt to use rubbing alcohol, or any other type of cleaner.

With the cover open and no cassette in place, put the recorder into play. The front of the cassette compartment will look like Fig. 2. If the recorder has not been cleaned in some time, you are likely to see a tan deposit (oxide from the tape) on all the labeled parts. That's the stuff that causes most of the CSAVE/CLOAD problems!

The first cleaning may take longer than usual because all the oxide must be removed. Work with a cotton swab just moistened with alcohol. Hold the damp swab against the turning pinch roller, *away from* the capstan. Continue this, renewing the moist cotton until the roller and the capstan are free of oxide. Next, clean the erase and record/play heads by rubbing them with fresh moist cotton swabs.

If you put the swab on the wrong side of the roller, some of the cotton is likely to get wrapped around the capstan. If this happens, put the recorder in "pause" or "stop," and slide the cotton up and off the capstan. Do not use metal, which may scratch the capstan. With the cotton removed, proceed with the cleaning.

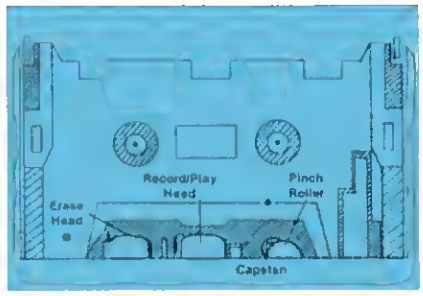

Fig. 2. Recorder Parts to be Cleaned

After the physical cleaning, you should clean away residual magnetism from the heads. This requires a head demagnetizer from the electronics/audio store. Be sure you buy one with a plastic-covered tip because a scratch on the head can be disasterous.

Follow the directions with your demagnetizer—turn it on; bring it to the head; slowly remove it from the head; turn it off. Note: Do *not* turn off the demagnetizer when it is near the head and do *not* use it near a program cassette.

This completes the cleaning procedure, unless the cassette compartment has accumulated some dust and lint. If so, some air and a brush with soft bristles should do the trick.

You should clean your recorder after every two or three hours of use. Clean it more often when running new tapes, because more oxide is deposited when tapes are new. A recorder that is cleaned regularly will need only two or three minutes maintenance—that's cheap insurance.

Two other operating procedures will help add life to your recorder. The first is to keep the lid of the cassette compartment closed except when inserting or removing a tape. This will help keep out the dust and lint.

Also, *never* leave the recorder in play or record unless it is pulling tape.

The rubber pinch roller is pressed tightly against the capstan in those modes. If left in pressure contact when not turning, the pinch roller can be deformed. An out-of-round roller will pull the tape unevenly and you can imagine how that will affect your 80.

With reasonable care, your cassette recorder/player will give long and trouble-free service.

Did you remember to send me information about your instructional program exchange group? If not, this is the last call. ■

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Reader Service—see page 242

80 INPUT

"While I thought the title was great. . . Some of the problems they encountered simply do not exist

Rites Reservations

This is in regard to an article entitled, "Rites of Passage," appearing in the August 1980 issue of *80 Microcomputing*.

While I thought the title was great, the article showed that the authors had not had much experience with their Model II. Some of the problems they encountered simply do not exist.

As a trusting type of person, I bought one of the first Model Ia, sight unseen, and repeated that performance when the Model IIs came out. So, I probably have had close to the maximum time anyone has had on both machines, outside of Ft. Worth.

The authors refer to the shift-lock as being important in that DOS commands require "all caps." While TRSDOS is fussy—unlike CP/M—and *does* require all uppercase letters, locking the shift control to uppercase will soon prove to be as much fun as a Cossack charge. The keyboard provides a key entitled CAPS, which does the job much better. Shift-lock will give you A, B, C, D, etc., but it will also give you < for a comma, > for a period, and ! @ # $, etc., for 1 2 3 4, etc. CAPS will give you what you expect, and still have correct numbers, periods, commas, and the like. If you want an &, for instance, you can shift to uppercase while in CAPS, and automatically return to CAPS after typing the uppercase letters.

While the authors appear to have stumbled across the BUILD command, they must not have used it much. They say to "[go to BASIC] you must go through a pain-in-the-neck sequence: type BASIC, a space, – F (for FILES), and the number of files you want open."

The BUILD command allows you to create TRSDOS files which can be called up and executed by the command DO, with the name of the file you had to BUILD. For example, if an operator always opened three files in BASIC, he could BUILD a file which might have the name, B3, for BASIC, with three files.

The "pain-in-the-neck" would only have to be endured once—to BUILD the file. Once that was resident on the diskette, the operator, to go to BASIC, would only have to type DO B3. TRSDOS would then execute the file, which would be the TRSDOS command, BASIC – F:3. (The authors forgot to mention the colon). The command could be BASIC – M:24000 (or whatever) which would tell BASIC not to use memory above 24000, in this case. It could be any number up to 32000.

Using BUILD and DO, an operator can set up BUILD files for the usual number of files he assigns, such as B1, B2, B3, etc. The BUILD file can contain a number of commands which will execute in sequence, and with one command, such as DO B3, you can turn the clock on, set the printer parameters, assign the I/O ports, and go to BASIC. Very easy, and no pain-in-the-neck at all.

There is a ROM, contrary to what the authors write, but it only is a power-up ROM, and shuts off after the diskette loads into memory. It does take longer than the Mod I, but having no BASIC on ROM, and the like, allows the Mod II owner to interchange languages very easily.

The authors say, "After paying several thousand dollars, we think the operator is entitled to a few words when the machine runs into an error. But not Tandy: It's back to the manual to find error codes again, just like Level II before DOS." Gentlemen, when the Mod II tells you an error number, such as **ERROR 3**, if you will perform the difficult task of typing ERROR 3, you will have displayed, "PARAMETER ERROR ON CALL." Any error number will be written out by typing back the number. This saves having to read the message, if you already know what error 13 is, for instance. No extra charge—included in the thousands.

They fail to mention the dynamite TERMINAL program which comes with the system, a program from which you can bounce to DOS and back, without losing your connection with the other computer, which allows you to save the incoming information on disk, or to transmit from your disk, or to print and display simultaneously—or not to—or to run information saved on disk from your terminal session—even without being on-line.

Joseph A. Greenleaf
Lyons, MI

Spare Bytes

I have a remark about your program called "Starfighter," August *80*, for 4K Level II. I am 11 years old and have a 4K Level I TRS-80. I liked the program and modified it to Level I easily, with more memory left. I did it by using abbreviations and P.AT instead of Print @. It does the same thing with 300 bytes to spare.

Shaun Naubert
West Chester, OH

KBFIX and Others

Today I called Tandy's computer hot line with the following problem: When loading programs with the KBFIX Keyboard Debounce routine resident in high memory, upon attempting to RUN the program, the entire program would crash, zero all memory and the screen would show MEMORY SIZE?. If I tried to load the Debounce routine after the program was in the computer, the routine canceled all line numbers after 730 and the program still crashed as above when trying to RUN it.

Tandy's explanation for this was as follows: "I saw a memo around here that said the KBFIX would only work with our (i.e., Radio Shack's) memory chips. If you're using someone else's chips the KBFIX may not work."

I recently bought a 16K upgrade kit from one of your most highly respected advertisers, and I have good reason to believe that all the bytes in these chips are good. Is it possible that the KBFIX debounce routine somehow requires chips with a faster access time than those supplied by Godbout and others? Since I have only a vague idea of how KBFIX operates—and it seems to me that it works on the keyboard memory, not on the RAM—perhaps some of your readers can save me the hours of labor in disassembling this routine to find out what it does and why, in this case, it isn't doing it!

A final question: I've noticed a BASIC

cont. on page 20

The following letters, critical of Radio Sheck's gama program Pyramid were forwarded to Radio Sheck shortly after their receipt in our offices.

We would have liked some response from Tandy on the authors of Pyremid. Should it be forthcoming, we'll pass it along to you.

Below, find what we hope is at leest a balanced "support/rebuttal" of a William O'Brien review that appeared in our August issue.—Eds.

O'Brien Lambasted

Anybody with an attantion span as short as William O'Brien's should not be allowed to writa softwara raviews for *80 Microcomputing*. His review of Pyramid in tha August issue took me aback.

You're *supposed* to take forever figuring out the secrets of the pyramid. Who wants to blow 15 bucks on an advanture program that can ba aolved by any moron in 20 minutes? Once solved, there's not much point in grinding *that* tape through tha player any mora.

The next time you writa a raviaw for this magazine, Mr. O'Brian, I suggest you evaluate tha subject mora thoroughly. Diatribes may ba fun to write, but they're not vary fair.

Jason Spicer
Vancouver, WA

O'Brien Reversed

I have just received my August issue of *80 Microcomputing*. Ona of the first things I read is the review section, and I must taka issua with William O'Brien and his review of Radio Shack's Pyramid game.

I too, feel Radio Shack has missed the boat in many arees of their computer support, but several of my friends and mysalf hava tha Pyramid progrem and have enjoyad hour upon hour of raal advantura while figuring out the game. Wa all have found out how to get past the serpent, catch the alusiva bird statue, when to wava the scepter and map out the Pyramid, *without* calling Taxas!

I feel this program is truly a good buy at $14.95, and an important step in tha right direction for Radio Shack. I would lika to see Radio Shack get the congratulations they clearly desarva, and encouragement for mora afforts towards games of this type. Not criticism by someone who obviously didn't spend the time to gain a proper raspect for this great program.

If you must ba told all tha solutions, don't bothar to play this game. But, if you have a good imagination, avarage intelligence and curiosity, tha Pyramid puzzle will give you many hours of challanging fun. And, just when you think you have it all down perfactly, *keep playing!* You may be in for a surprise!

Jim Nageotte
Monterey, CA

Pyramid Remodeled

William O'Brien's feelings are similar to those of many paople when they first experience a fantasy/adventure type game.

To start, I think calling the writer of an adventure program is about as brash as writing a nasty letter to God because you aren't president. If you can't solve a problem, you aren't thinking hard anough. As for the limited vocabulary of this game, it is much biggar than Mr. O'Brian asserts.

A simpla PEEK through the program yielded the verb vocabulary Rub, Eat, Drink, Jump, Climb, Go, Hit, Break, Kill, Hurt, Taka, Get, Drop, Throw, Help and quita a few others that give too much away for ma to want to list. While a few commands (like HELP, and RUB) are usad for nothing but a few humorous comments, there is certainly nothing wrong with that.

The game itself is quite larger than Mr. O'Brien said. Tha advanture world consists of more than 30 rooms, as well as a very larga (mora than 10 room) maze. All you have to do is defeat some of the various obstacles blocking your progress, like the chasm and the guardian serpent. You won't gat any further than the few beginning rooms until you start to think logically and cunningly. This coupled with several humorous random ramarks when you do outrageous things (try eating the serpent) maka Pyramid a game well worth tha monay.

One thing though. Those of us who played Crowther and Woods original adventure will nota definite similarities with some of the room descriptions and solutions to problems. I wasn't fooled by changing a 'rod with a rusty star on an and' to 'a scepter with an ankh on an and'. But since I never got very far in the original Adventura, I did not find this detracted from tha game.

So perhaps in the future some of the review work dona should be given closer scrutiny befora it makas print.

Paul Vader
Chicago, IL

Compares Adventure

The Radio Shack game Pyramid, reviewed in your August issue, is a close copy of Advanture, also known as Colossal Cave, tha granddaddy of all advantura gamas. Adventure was originally written by Will Crowther and later extensively expanded by Don Woods around 1970. (It is mentioned in your July article on Scott Adams.) Adventure was written in FORTRAN and has been available on meny large time-sharing systems for years.

The exact correspondence between Pyramid and Advanture will be obvious to anyona who has played both. Pyramid has simply altered the text describing tha rooms and objects, without altering the directions you must mova in, or tha solutions to specific problems.

In both gamas you begin by dascending into an underground chamber and walking to the west through savaral mora chambers. You pick up a magic wand (a sceptre in Pyramid) in tha second room, which you must set down before capturing a bird (a bird statue in Pyramid) in a birdcage (a statue box, whatever that is) in tha third room.

Then you descend a staircase beside a small pit, down a rock dome to the aast end of a huge chamber. To the west is a bottomless chasm. You wave the wand/sceptre and a bridge appears across the chasm. You can dascand from tha dome to a room guarded by a fearsome dragon/serpent, who can be drivan away by the bird/statue.

Further west is a maze, having the same pattern in both games, where lurks a vanding machine that dispensas batteries for your lamp. And so forth.

Radio Shack has considerably reduced the size and complaxity of the original, presumably in order to sell it to owners of 16K systems. The axe-throwing dwarves have been removad and certain regions of tha cavern ara lopped off. But one can only speculate why Radio Shack bothered to change tha text. (Dark motivas?)

If anyone knows where Crowthar and Woods ara, I would be very interested to hear from them about this. The net effact is to maka the gama less fun. As your reviewer noted, there's no reason to try waving a sceptre but magic wands were made to be waved.

Robert P. Sather
Bucyrus, OH

command in some recent issues that is not listed in the Level II handbook, and I can't figure out what it does. A sample is Line 920 of the "Star Search" program (*80 Microcomputing*, August 1980): FORI = X + (X<>1) TOX – (X<>8): (etc.). Now, what is that (X<>1) all about? Is it a MAX function?

Warren S. Kirkland
Vacaville, CA

Is MEMORY SIZE being set correctly before loading KBFIX? Sounds like that could be the answer.

(X<>1) is a true/false expression. A value of – 1 is returned if the expression is true (in this case if X is not 1), and a value of zero is returned if it is false.—Eds.

One-Byte Break Disable

In response to your article on BREAK disable, for those who do not want to go to the trouble to key in the 30 bytes or so, here is a one byte BREAK disable:

```
POKE 16396,  62 (to disable break)
POKE 16396, 201 (to enable break)
```

Enjoy your magazine very much.

Saturn Software
Gila Bend, AZ

Lowercase Access

Those who have installed a lowercase mod in their 80s may know that there are several characters in the character-generator ROM which are not normally accessible to BASIC. Here is a short demo program using a subroutine which PEEKs the cursor position and executes a POKE which will put these characters on screen.

```
10 CLS
20 PRINT@530,"THIS IS A";:XX = 72:GOSUB 1000
30 PRINT"AND THIS,";:76:GOSUB 1000
40 PRINT",IS NOT.":END
1000 A = PEEK(16417):B = PEEK(16418):IF A>60 THEN
     CP = ((A – 80)*256) + B ELSE CP = B
1010 POKE 15360 + CP,XX: PRINT@CP + 2,"";
1020 RETURN
```

The variable XX determines the character. The values of interest for this program are 64 through 127.

Speaking of character generators, I have it from a fairly reliable source (Radio Shack), that the chip used in their $99 lowercase mod is Motorola part #SCM37530P. I would be obliged to anyone who could point me to a source for this device.

Patrick Kelley
Houston, TX

80 AID

TAB Problem

I own a TRS-80 48K system (serial #29188) with two Percom 5-inch and two Parasitic 8-inch floppies and an Integral Data Systems IP125 Printer which is connected to the parallel port. As the serial number suggests, my CPU is one of the earlier models but I have not had any hardware failures so far. I had a lot of software problems until I started to use NEWDOS/2.1. I now have NEWDOS/80 which I shall use as soon as Parasitic Engineering has written the software patch to use it on my 77 track/15 sectors 8-inch floppies. However, there is something that has always puzzled me. Maybe your readers can try the following example.

```
10 LPRNT TAB(63);"TEST"
20 LPRINT TAB(70);"TEST"
```

On my system line 10 works fine, however, after 64 tabs my ROM outputs first a CR/LF and then prints the remaining tabs on the following line. This means that I can never print anything past tab 63. For this reason I have to use the STRING$ function in my programs.

Do other readers have the same problem or do I just have an outdated ROM with a bug?

Rolf Roethlisberger
34 Rue Daubin
CH-1203 Geneva
Switzerland

TCOPY BASIC

I am writing in reference to my article entitled TCOPY which appeared on page 160 of the July issue of *80 Microcomputing*. The article presented a Level II machine language program to copy any Level I or Level II cassette tape, and it pointed out that since the program is short, it can be easily POKEd into memory from BASIC.

Correspondence from readers indicates that writing such a BASIC program is not easy for everyone. Therefore, I am communicating the following BASIC program to provide TCOPY to those readers. The program also provides automatic memory protect, provides prompting to guide the user and provides execution from the BASIC mode via the USR command.

The program execution is terminated by pressing the reset button. While this may result in loss of the BASIC code in some versions of the Level II machine, the machine code version of TCOPY will remain and can be executed by entering SYSTEM and then /20435 after the prompting symbols *?.

This program is available from the undersigned in a package that includes the utility program TDUMP. The program TDUMP dumps the contents of any Level II tape in ASCII, hexadecimal or decimal. It can be used to identify file names or tape formats. For example, you will discover that source code generated by the EDTASM consists almost entirely of ASCII code. The package price is $5.95.

Dennis Stevens
10895 Kemah Lane
San Diego, CA 92131

```
100 POKE16561,209 POKE16562,79 CLEAR50:
    POKE16553,255
110 DATA62,4,211,255,33,63,60,219,255,23,48,
    251,6,50,16,254,62,5,211,255,6,16,254,62,6,
    211,255,6,16,16,254,62,4,211,255,126,60,
    246,128,230,191,119,24,218
120 CLS:FORI = 20435TO20479:READX:POKE
    I,X:NEXT:POKE16526,211:POKE16527,79
140 PRINT"INSERT THE BLACK JACK INTO
    THE EAR CONNECTOR OF THE SOURCE
    RECORDER AND PUT THAT RECORDER
    IN THE PLAY MODE. INSERT THE LARG-
    ER GREY JACK INTO THE AUX CONNEC-
    TOR OF THE DESTINATION RECORDER
    AND PUT THAT RECORDER IN THE REC
    ORD MODE
150 INPUT"THEN PRESS ENTER TO START
    THE COPY
";:CLS:PRINT"TERMINATE THE PROGRAM
BY PRESSING THE RESET BUTTON":X =
USR(0)
```

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80 DEBUg

CHAR.	ASCII	CORR.	CHAR.	ASCII	CORR.
Q	81	68	h	104	33
R	82	93	i	105	20
S	83	81	j	106	?
T	84	103	k	107	36
U	85	110	l	108	41
V	86	94	m	109	31
W	87	80	n	110	38
X	88	111	o	111	25
Y	89	65	p	112	5
Z	90	119	q	113	4
[(E)	91	101	r	114	29
TAB	94	126	s	115	17
	95	64	t	116	39
a	97	28	u	117	46
b	98	32	v	118	30
c	99	44	w	119	16
d	100	45	x	120	47
e	101	37	y	121	1
f	102	14	z	122	55
g	103	15			

NOTE: All values are decimal. When decoded into binary the correspondence code represents the following:
(MSB) Control Char/Shift/T2*/T1*/R5/R2a*/R2*/R1*

Table 1. ASCII and Correspondence codes. All values are decimal. When decoded into binary the correspondence code represents (MSB)Control Character/Shift/T2/T1*/R5/R2e*/R2*/R1*(LSB).*

		5 volts	Ground
IC1, IC2*	74S387	16	8
IC3, IC4	74175	16	8
IC5, IC6, IC7, IC15	7406	14	7
IC8, IC24	74121	14	7
IC9, IC10	74123	16	8
IC13	7400	14	7
IC14	7402	14	7
IC16	7486	14	7
IC17	74LS367	16	8
IC18, IC19	74LS175	16	8
IC20	74LS30	14	7
IC21, IC23, IC29	74LS02	14	7
IC22	74LS20	14	7
IC25, IC26, IC27, IC28	74LS85	16	8
IC11, IC12	7474	14	7

Teble 2. Intagrated circuits parts list end power supply pin connections.

PIN	SIGNAL	PIN	SIGNAL
25	A0	27	A1
40	A2	34	A3
31	A4	35	A5
38	A6	36	A7
11	A8	17	A9
4	A10	9	A11
5	A12	6	A13
10	A14	7	A15
30	D0	22	D1
32	D2	26	D3
18	D4	28	D5
24	D6	20	D7

13	WR*	15	RD*
12	OUT*	19	IN*
1	RAS*	3	CAS*
2	SYSRES*	23	TEST*
21	INT*	14	INTAK*
16	MUX	33	WAIT*
8	GND	29	GND
37	GND	39	+5 volts-limited current

Table 3. TRS-80 expansion port pin designations.

PIN	SIGNAL	PIN	SIGNAL
1	Electromagnet Common (+46 volts)	13	Tab
		15	Index
3	R2	17	Ground
5	R5	19	Shift up feedback
7	T2	21	Shift down feedback
9	Ground	23	Control/Print feedback
11	CR-LF	25	Ground

PIN	SIGNAL	PIN	SIGNAL
2	R1	14	Backspace
4	R2a	16	Ground
6	T1	18	Shift up Electromagnet
8	Strobe Electromagnet	20	Shift down Electromagnet
10	Ground	22	Ground
12	Space	24	Feedback ground

Table 4. 25-pin D connector pin designations.

I would like to apologize to readers for several errors that crept into my article, *Selectric Herd Copy* in the September issue. The worst problem was the missing parts list which somehow did not get published. In addition, there are severel errors in the schematic diagrams. Fig. 3 has a number of mistakes.

1. The two unlabeled connections on the bottom of IC1 and top of IC2 should be 13 and 14. Therefore, pins 13 and 14 from both IC1 and IC2 are grounded.

2. There are also unlabeled connections on the bottom of IC3 and top of IC4. These should read 1 and 8 on IC3 and 16, 1 and 8 on IC4. Thus, pins 16 and 1 of both IC3 and IC4 are to +5 volts and pin 8 of both ICs is grounded.

3. Pins 6 and 7 of IC10b are reversed.

4. Pin 4 of IC8 should go to +5 volts, not to ground as shown.

5. Pin 8 of IC11b should be pin 9, therefore, pin 9 of IC11b goes to pin 3 of IC11a.

Severel readers seemed confused as to where the lines marked R1, R2, R2a, etc. go. It might be worth mentioning that these lines go through a 560 ohm resistor to the darlington transistor driving the electromagnet as shown in Fig. 4. Thus, the line labeled R1 goes to a resistor then to a darlington transistor driving the R1 electromagnet. Likewise, R2 goes to the resistor, transistor and R2 electro-

80 DEBUg

magnet, etc. IC5, IC6 and IC7 drive a total of 11 transistors which drive 11 electromagnets. In addition, the strobe, shift up and shift down lines each go through a 560 ohm resistor, and a transistor to their respective electromagnets.

Figures 5, 6 and 7 have similar mistakes. First, in all three schematics, pins 3 and 4 of IC24 should go to +5 volts, not to ground as shown. Second, the line marked 37E8 READ in Fig. 5 should be inverted before going to pin 1 of IC17. Therefore, break this line on the schematic and connect another NOR gate in the circuit. Pin 4 of IC23 should go to pins 11 and 12 of IC23 (the new NOR gate) and the output of this gate, pin 13, should continue up to pin 1 of IC17. And finally, the same correction applies to Figs. 6 and 7. In both of these figures the lines marked READ should be inverted. Therefore, break the READ line and connect pin 1 of IC29 to pins 11 and 12 of IC29 (the new NOR gate) and connect the output of this NOR gate, pin 13, to pin 1 of IC17.

A final correction I would like to make known is in Table 5. Address 140 should have 186 as its data, not 066 as shown. Also address 212 should have 204 as its data, not 202 as shown.

I would like to thank all readers for the nice comments they have made about this article. I will be pleased to correspond with anyone about interfacing the Selectric if he or she will include a stamped, self-addressed envelope. Also, I will have a printed circuit board available about the middle of November. Please note that I have moved since I wrote this article. My new address is 248 Barren Hill Road, Conshohocken, PA 19428 and my phone is 215-825-7556.

Michael W. Bickerton, M.D.

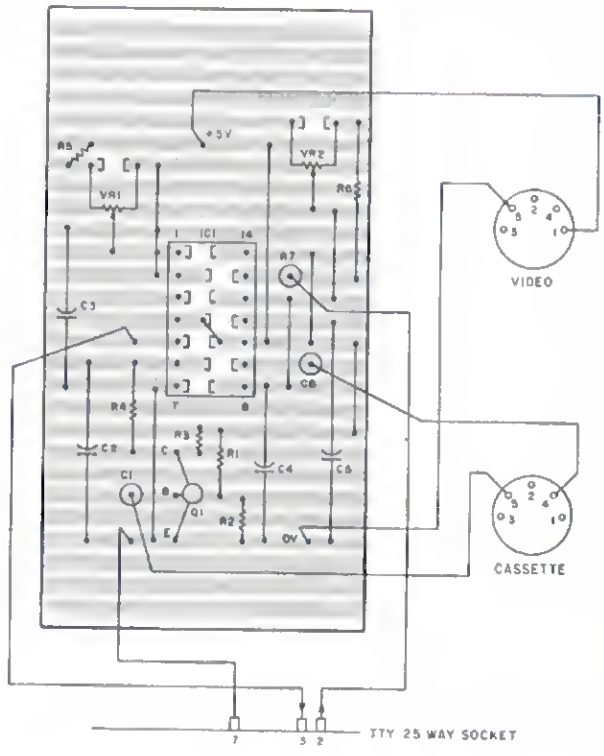

Figure correction for Teletype Interface, September 80.

The Next Trap

Could you please publish these corrections for "The Next Trap," September 1980: The program listing shown does NOT belong to this article. This is the correct listing:

```
10 CLS
20 INPUT "ENTER A NUMBER 1 - 10";C
30 FOR A = 1 TO 8 : PRINT "A = ";A,
40 IF A = C THEN 50 ELSE NEXT A
50 PRINT:PRINT"OUT OF THE LOOP"
60 FOR B = 1 TO 5
70    FOR A = 1 TO 8
80       PRINT"B = ";B;" A = ";A,,
90    NEXT A
100   PRINT
110 NEXT B
120 END
```

To correct the "ROM-TEST-PROGRAM" in the appendix 'C' of the Level I manual, insert this line : 280 X = 99:NEXT X.

The text is also scrambled up a bit:
From: "The first one in line 30 and 40" continue at "exacutes nine times unless you. . . ."
From: ". . . . should have forgotten.)" continue at "The program then enters two. . . ."
From: ". . . . won't let you do this and out" continue at "comes the message ?NF ERROR. . . ."

Hubert C. Barrmann
Colorado Springs, CO

Customized EDTASM

I have found the following three errors in my article "Customized EDTASM" in August's edition. Enclosed are the corrections.

EDTASM Corrections

1) The end of EDTASM is 5D20(H), vise 5520(H).

The next two are both in listing 4.

2) The first is in line 550. There should be a NOP in the instruction field.

3) Line 600 should read: CP 54D instead of: CP 34D. This sets the number of lines to be printed on a page.

John T. Blair
Norfolk, VA

80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

"In short, the Model II is physically capable of being used in a multiprocessing or shared-logic environment, but when?"

In previous columns I have discussed some of the limitations of microcomputers in a business environment. At present the Model II is subject to the same limitations of the Model I: Basically, it is still a single-user machine. However, these limitations may be temporary. Radio Shack recently released a technical manual for the Model II, indicating that four expansion slots are available. These slots significantly increase the Model II's capacity. The Model II is capable of addressing up to 512K of memory. In addition, the bus structure is already expanded to accommodate the new 16-bit microprocessors.

In short, the Model II is physically capable of being used in a multiprocessing or shared-logic environment, but when? At present Radio Shack has given us no indication of additonal hardware to plug into the Model II. The machine has remained exactly as it was offered more than a year ago.

Communications Program

In the meantime, currently packaged with the Model II is a terminal program which can greatly enhance its capacity as a stand-alone computer.

As illustrated in the user's manual the program is designed to help simplify the installation of a Model II as a "remote job entry" work station for a larger computer.

Take the example of preparing a tax return. Typically, the preparation begins with an assembly phase. During this phase the data are usually gathered in pieces. Once all the data are on hand, a return can be prepared and reviewed for accuracy and sent to the taxpayer.

To automate tax preparation many professionals use a batch data entry service bureau. Tax return information is entered on input forms which are keypunched. The returns are processed at the service bureau and returned with diagnostics. The diagnostics are analyzed and corrections added to the batch. Once the batch is correct the final returns can be prepared. Either the final return or the diagnostic report is reviewed for tax compliance and accuracy.

If gathering the data and entering it into the computer could be done by the preparer and, during the data entry phase, diagnostics performed, preparation could be expedited. However, this requires considerable computer capacity. The capacity "crunch" could be averted by using a computer such as the Model II, to off-load data entry from the main computer. The main computer would be reserved for complicated work and the Model II, together with a program such as Terminal, could be used for the slow data entry work. In practice this could work as follows:

On a daily basis, tax files could be transmitted to the Model II from the main computer. The files could be operated on and returned. The main computer would generate reports on each return. Should a return show "no activity" for a period of time, a warning could be generated to indicate that special attention is required.

No batching would be required by this system. The instant feedback between data entry and edit would shorten the learning curve for new staff and minimize costly data omissions for all users.

Terminal is an interactive menu-driven program designed to transmit files from the Model II to another computer. In operation, the disk file is brought into the Model II memory and transmitted from memory to the host computer. Files transmitted must be in ASCII form and the transmission process can be controlled by the host through a predefined "wait" character. The Terminal program does not appear to be able to audit the transmitted text, identifying errors. Because of this limitation, some way of verifying the accuracy of sensitive data must be used. Data received from the host computer can be either dumped into memory, printed or displayed on the video screen.

When data is received, the program will detect if a parity or framing error occurs. These errors can occur if the Model II is not precisely adjusted to the host computer's specifications. Because the menu may be displayed during data reception, the program indicates the reception of data which was not displayed. Should the host signal a break, a message will be displayed. Other allowances have also been incorporated to indicate "loss of carrier" during network communications.

ST80 III

Another program which has even more flexibility is ST80 III by Lance Micklus (Small Business Systems Group, Inc., Westford, MA). This program, an adaptation of a package designed for the Model I, is considerably more versatile than Terminal. In the ST80 III system conditions are set up by a special program TCONV/BAS.

This program is designed to tailor the Model II to almost any specifications required by the host computer. ST80 III can alter keyboard, memory buffer, video and printer conventions to that of the host.

An excellent feature for the ST80 III user is the availability of feedback between the host and the Model II that allows character by character verification when sending data. This feature alone and the elimination of requirements for a special program justifies the cost of the ST80 III. However, Lance Micklus did not stop there.

Included with the program are several useful utilities. These utilities convert binary to ASCII files and vice versa; calculate checksums for transmission verification and determine whether a file is ASCII or binary.

The Model II has been used successfully in networks composed of many different types of computers, by setting up different parameter files for each computer. Simply call a different parameter file and the Model II is automatically adjusted to the host system's requirements.

For fine tuning the ST80 III, you can manually adjust its transmitting and receiving speeds so that slight synchronization errors can be corrected. This is especially desirable if the host is time-shared with other peripherals.

ST80 III is sold with parameter tables for the Source and Forum 80. An examination of these tables with TCONV/BAS, will give the user a graphic appreciation of the problems involved when trying to integrate dissimilar data processing devices.■

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Try to think of *80 MICROCOMPUTING* as more of a large club newsletter than an ivory tower high-level publication. I'll leave the pomp to other publishers...the ones with the well-deserved inferiority complexes who cater to their inadequacies by publishing esoteric beloney. This magazine is written by the readers and edited by people whose aim is to help you enjoy your TRS-80*.

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80 APPLICATIONS

by Dennis Kitsz

"Although a machine language program is usually clear and transparent, in this case, the BASIC gives the illusion of being more concise."

Remember that stock introduction on The Twilight Zone? Can you still hear Rod Serling intoning detached phrases combined with black-and-white images blending and diffusing on the screen? Time was always a strong element in his television program, and it came to mind as this month's Applications program consistently demeterielized in the twilight zone of my TRS-80. This month's column about time...was late.

Having thus justified my tardiness to the editors, I will move straight to programs for setting and reading time using the hardware detailed last month. Listing 1 is a BASIC program to do this with the MSM5832 clock/calendar. Although a machine language program is usually clear and transparent, in this case the BASIC gives the illusion of being more concise.

The Controlling Program

Any complicated input/output peripheral calls for a lot of information from the controlling program; this is true for the clock chip as well. Thirteen of its 16 internal registers are used for month, day, year, hours, minutes, seconds and day of the week. Additionally, its slow internal electronics force us to use interface hardware which can grab hold of the clock signals and stabilize them for the computer to read.

Last month we mapped the 8255 interface chip to use addresses 37D0 to 37D3 (14288 to 14291 decimal). Address 37D3 communicates instructions to the port chip itself, readying it to relay data; via the port chip, address 37D2 sets up the clock to read or write; data sent to 37D1 determine which of the 13 registers will be activated; and 37D0 contains the actual time and data information to be read or written.

Sound complicated? It isn't if you work slowly and logically. You can merely use this hardware, but it is worth understanding it as well.

The hardware explained last month takes care of decoding an address block starting at 37D0 hex, which turns on (selects) the 8255 port IC. The lower two bits of the addressing lines are fed directly into that chip, and they determine (once the 8255 has been selected) what the chip will do next. 37D3 (0011 0111 1101 0011 binary) allows data to talk to the chip, determining which of its three ports will read or write. 37D2 (. . . . 10) sets up communications with Port C, 37D1 (. . . . 01) with Port B, and 37D0 (. . . . 00) with Port A.

We send data through Port C, then, to tell the clock whether "it" will read or write. "Data" through Port B select the clock's register "address". And finally, Port A is used to transfer what we think of as "normal" data to and from the clock.

Lines 10 to 70 of the BASIC program accept raw input from the user in order to set the clock. Notice that in line 80, a value of 4 is added to variable HO to indicate afternoon. Since there are only 24 hours in a day, the hours high digit will never be greater then 2, or binary 0010. The two leftmost bits aren't used for counting, so they have been set aside to indicate AM or PM. Four is 0100 binary, so adding 4 to variable HO "sets" the PM bit in the clock.

The same thing happens in line 90; the remaining high bit of the hours register can reveal whether we are using a 12 or 24-hour clock.

Monday has been assigned a value of zero by the chip's makers; lines 100 and 110 make that conversion. Determination of leap year is not automatic, our own program must determine it by discovering (in line 140) if the year is divisible by four with no remainder. Input from the user is then

```
10 CLS : CLEAR 150 : REM * CRUDE BUT SERVICEABLE CLOCK PROGRAM
20 FOR X = 0 TO 6 : READ DW$(X) : NEXT : REM * ARRAY OF DAYS
30 DATA M O N D A Y,T U E S D A Y,W E D N E S D A Y
40 DATA T H U R S D A Y,F R I D A Y,S A T U R D A Y,S U N D A Y
50 PRINT "ENTER HOURS AND MINUTES, PLUS AM OR PM INDICATION."
60 INPUT "USE FORMAT 0,3,5,0,P (= 3:50 P.M.)";H0,H1,M0,M1,P$
70 INPUT "12-HOUR OR 24-HOUR CLOCK (ANSWER 12 OR 24)";C$
80 IF P$ = "P" THEN H0 = H0 + 4 : REM * BIT 3 INDICATES P.M.
90 IF C$ = "24" THEN H0 = H0 + 8 : REM * BIT 4 FOR 24 HOURS
100 PRINT "DAY OF THE WEEK (ENTER 1 TO 7. MONDAY IS 1.)"
110 INPUT DW : DW = DW - 1 : REM * CLOCK'S MONDAY IS ZERO
120 PRINT "MONTH, DAY AND YEAR IN FORMAT 0,3,3,1,8,0 (3/31/80)"
130 INPUT M2,M3,D0,D1,Y0,Y1 : REM * LEAP YEAR TEST IN NEXT LINE
140 LY = Y0 + 10 * Y1 : IF LY/4 = FIX (LY/4) THEN D0 = D0 + 4
150 POKE 14291,128 : REM * SET UP 8255 CHIP PORTS
160 POKE 14290,80 : REM * SET UP CLOCK TO READ TIME AND DATE
170 Q = 14289 : REM * THIS IS CLOCK ADDRESS REGISTER
180 POKE Q,2 : POKE Q-1,M1 : POKE Q,3 : POKE Q-1,M0
190 POKE Q,4 : POKE Q-1,H1 : POKE Q,5 : POKE Q-1,H0
200 POKE Q,6 : POKE Q-1,DW : POKE Q,7 : POKE Q-1,D1
210 POKE Q,8 : POKE Q-1,D0 : POKE Q,9 : POKE Q-1,M3
220 POKE Q,10 : POKE Q-1,M2 : POKE Q,11 : POKE Q-1,Y1
230 POKE Q,12 : POKE Q-1,Y0 : REM * TIME AND DATE INFO SET
240 POKE 14291,144 : CLS : REM * DISPLAY SUBROUTINE FOLLOWS
250 PRINT @ 0, ""; : REM * DISPLAY IS ON TOP LINE OF SCREEN
260 POKE 14290,32 : REM * SET UP CLOCK TO WRITE TIME AND DATE
270 POKE Q,6 : PRINT DW$ (PEEK (Q-1) AND 15)", ";
280 POKE Q,10 : PRINT PEEK (Q-1) AND 15; CHR$(8);
290 POKE Q,9 : PRINT PEEK (Q-1) AND 15; "/";
300 POKE Q,8 : PRINT PEEK (Q-1) AND 3; CHR$(8);
310 POKE Q,7 : PRINT PEEK (Q-1) AND 15; "/";
320 POKE Q,12 : PRINT PEEK (Q-1) AND 15; CHR$(8);
330 POKE Q,11 : PRINT PEEK (Q-1) AND 15; " -- ";
340 POKE Q,5 : PRINT PEEK (Q-1) AND 3; CHR$(8);
350 POKE Q,4 : PRINT PEEK (Q-1) AND 15; ":";
360 POKE Q,3 : PRINT PEEK (Q-1) AND 15; CHR$(8);
370 POKE Q,2 : PRINT PEEK (Q-1) AND 15; ":";
380 POKE Q,1 : PRINT PEEK (Q-1) AND 15; CHR$(8);
390 POKE Q,0 : PRINT PEEK (Q-1) AND 15;
400 POKE Q,5 : IF (PEEK (Q-1) AND 4) = 0 THEN PRINT " A. M.";
410 : IF (PEEK (Q-1) AND 4) = 4 THEN PRINT " P. M.";
420 IF (PEEK(14312) AND 128) = 0 THEN 500 ELSE 250
430 REM : THIS ROUTINE IS MUCH LONGER THAN IT NEED BE,
440 REM : BUT IS SET UP FOR CLARITY, NOT EFFICIENT USE
450 REM : OF MEMORY. IT IS EASIER TO USE THE MACHINE
460 REM : LANGUAGE SUBROUTINE FOR THIS CLOCK CIRCUIT.
500 A$ = "" : FOR X = 15360 TO 15424 : A$ = A$ + CHR$(PEEK(X) )
510 NEXT : LPRINT A$ : GOTO 250
```

Program Listing 1

complete.

Line 150 switches on the port chip's write cycle, and line 160 does the same with the clock chip. Following through lines 160 through 230, we find that each clock register is prepared for writing (POKE Q), and each value is placed into the clock's registers (POKE Q-1). The clock and calendar are now set.

Reading the Clock

Reading this clock is not as straightforward in Level II BASIC as it seems to be with the Level III and DOS "TIME$" command. Line 240 allows the 8255 port chip to read the clock, and line 260 prepares the clock for reading.

Lines 270 through 390 each ask for a clock register (POKE Q) and subsequently read it with a PEEK(Q-1). Don't be put off by the AND function in each of these lines, nor by the CHR$(8). The AND function does in software what would have been messy in hardware; that is, we're only using four of eight data lines. The remaining four are not tied off, and the computer sees them as high (equal to a number one). Because of these high lines, every time we read data from the clock, the computer dutifully adds 240 to it (binary 11110000).

To rid ourselves of the nuisance of trying to interpret a date like 241242/242245/248240, we "mask" out all the bits we don't want to read. Thus AND 15 is AND 00001111 to the computer. Only numbers up to 15 will be seen through this mask. In line 340, there's AND 3 (binary AND 00000011). This mask rids us of the bits used for AM/PM and 12/24-hour clock.

Lines 400 and 410 use the opposite masks. They mask out the hours values in the register in order to find out if it is morning or afternoon, or if we have requested a civilian or military clock. The CHR$(8), by the way, is a command for "displaying" a backspace, so that the time value will be formatted nicely on the screen.

The remainder of the program checks address 14312 for the presence of a printer, formats the output as a string (line printers normally can't backspace), and sends the output to the printer if it is ready.

I recommend the BASIC program, though, only for an idea of how the 8255 port and 5832 clock chips work, not for actual program use. Instead, Listing 2 presents an assembly language routine which will print a formatted time and date using TIME$, and set the time and date using CMD. Because I have annotated the listing in detail, only the general approach and use of the machine language routine will be outlined.

```
                00140 ;*****************************************************
7EA7            00150         ORG     7EA7H           ; CHANGE TO RELOCATE
                00160 ;*****************************************************
                00170 ; PATCH INTO DOS TIME$ & CMD ERROR LOCATION AND CHANGE IT
                00180 ;-----------------------------------------------------
7EA7 21B67E     00190 ENTRY   LD      HL,START1       ; START OF TIME$ PROGRAM
7EAA 227741     00200         LD      (4177H),HL      ; PATCH TIME$ ?L3 ERROR
7EAD 21547F     00210         LD      HL,START2       ; START OF "CMD" PROGRAM
7EB0 227441     00220         LD      (4174H),HL      ; PATCH CMD ?L3 ERROR
7EB3 C3CC06     00230         JP      06CCH           ; BACK TO A BASIC "READY"
                00240 ;*****************************************************
                00250 ; THIS IS THE BEGINNING OF THE "TIME$" PATCH TO READ TIME
                00260 ; ROUTINE INTERCEPTS ?L3 ERROR AND CHECKS LINE'S SYNTAX.
                00270 ;-----------------------------------------------------
7EB6 D7         00280 START1  RST     10H             ; BASIC HOUSEKEEPING
7EB7 E5         00290         PUSH    HL              ; SAVE BASIC LINE POINTER
7EB8 3E18       00300         LD      A,18H           ; LENGTH OF TIME$
7EBA CD5728     00310         CALL    2857H           ; ROM STRING SPACE SETUP
                00320 ;*****************************************************
                00330 ; SET UP RAM SPACE AND GET CLOCK CHIP READY TO READ TIME
                00340 ;-----------------------------------------------------
7EBD 2AD440     00350         LD      HL,(40D4H)      ; LOCATION TO STORE TIME$
7EC0 FD21D037   00360         LD      IY,37D0H        ; CLOCK MEMORY ADDRESS
7EC4 FD360390   00370         LD      (IY+3),90H      ; SET UP 8255 CHIP PORTS
7EC8 FD360220   00380         LD      (IY+2),20H      ; SET UP CLOCK TO READ
                00390 ;*****************************************************
                00400 ; CLOCK IS READY TO READ ... NOW READ AND CREATE STRING.
                00410 ; DAY OF THE WEEK IS ALPHABETIC AND WILL BE DONE FIRST.
                00420 ;-----------------------------------------------------
7ECC FD360106   00430         LD      (IY+1),6        ; POINT TO DAY OF WEEK
7ED0 FD7E00     00440         LD      A,(IY+0)        ; GET DUMMY VALUE INTO A
7ED3 FD7E00     00450         LD      A,(IY+0)        ; GET DAY OF WEEK VALUE
7ED6 E607       00460         AND     07H             ; MASK OFF UNUSED BITS
7ED8 11EA7F     00470         LD      DE,TABLE        ; POINT DE TO DAY TABLE
7EDB 3C         00480         INC     A               ; IT MUST BE AT LEAST 1
7EDC 3D         00490 LOOP1   DEC     A               ; IS ACCUMULATOR ZERO?
7EDD 2807       00500         JR      Z,XLOOP         ; GO OUT OF TABLE LOOP
7EDF 0603       00510         LD      B,3             ; NUMBER OF CHARS PER DAY
7EE1 13         00520 LOOP2   INC     DE              ; MOVE PAST EACH CHAR
7EE2 10FD       00530         DJNZ    LOOP2           ; DO IT TILL AT NEXT DAY
7EE4 18F6       00540         JR      LOOP1           ; CHECK FOR NEXT DAY
                00550 ;*****************************************************
                00560 ; VALUE FOR DAY IS FOUND ... NOW TURN IT INTO LETTERS
                00570 ;-----------------------------------------------------
7EE6 0603       00580 XLOOP   LD      B,3             ; NUMBER OF CHARS TO GET
7EE8 1A         00590 YLOOP   LD      A,(DE)          ; CHARACTER TO TRANSFER
7EE9 77         00600         LD      (HL),A          ; XFER DAY NAME TO TIME$
7EEA 23         00610         INC     HL              ; NEXT LOCATION IN TIME$
7EEB 13         00620         INC     DE              ; NEXT LOCATION IN TABLE
7EEC 10FA       00630         DJNZ    YLOOP           ; LOOP BACK FOR NEXT CHAR
7EEE 3620       00640         LD      (HL),20H        ; PUT SPACE AFTER DAY
7EF0 23         00650         INC     HL              ; BUMP TIME BUFFER AGAIN
                00660 ;*****************************************************
                00670 ; DAY OF WEEK IS DONE ... NOW GET MONTH, DAY, AND YEAR
                00680 ;-----------------------------------------------------
7EF1 1E30       00690         LD      E,30H           ; HEX TO ASCII DIFFERENCE
7EF3 1608       00700         LD      D,11            ; MONTH BI PORT + 1
7EF5 062F       00710         LD      B,2FH           ; SLASH ("/") CHARACTER
7EF7 0E0F       00720         LD      C,0FH           ; MASK UNUSED PORT BITS
7EF9 CDDB7F     00730         CALL    FILLER          ; GET MONTH HIGH VALUE
7EFC CDDB7F     00740         CALL    FILLER          ; GET MONTH LOW VALUE
7EFF 70         00750         LD      (HL),B          ; LOAD SLASH INTO TIME$
7F00 23         00760         INC     HL              ; BUMP TIME BUFFER BY ONE
7F01 0E03       00770         LD      C,3             ; MASK UNUSED CLOCK BITS
7F03 CDDB7F     00780         CALL    FILLER          ; GET DAY HIGH VALUE
7F06 0E0F       00790         LD      C,0FH           ; MASK UNUSED CLOCK BITS
7F08 CDDB7F     00800         CALL    FILLER          ; GET DAY LOW VALUE
7F0B 70         00810         LD      (HL),B          ; PUT SLASH INTO TIME$
7F0C 23         00820         INC     HL              ; BUMP TIME BUFFER BY ONE
7F0D 160D       00830         LD      D,13            ; YEAR HIGH VALUE + 1
7F0F CDDB7F     00840         CALL    FILLER          ; GET YEAR HIGH VALUE
7F12 CDDB7F     00850         CALL    FILLER          ; GET YEAR LOW VALUE
7F15 3620       00860         LD      (HL),20H        ; VALUE FOR A SPACE
7F17 23         00870         INC     HL              ; BUMP TIME BUFFER BY ONE
                00880 ;*****************************************************
                00890 ; MONTH, DAY, YEAR DONE - NOW GET HOURS, MINUTES, SECONDS
                00900 ;-----------------------------------------------------
7F18 1605       00910         LD      D,5             ; HOURS HIGH VALUE POS'N.
7F1A FD7201     00920         LD      (IY+1),D        ; SET UP CLOCK CHIP PORT
7F1D FD7E00     00930         LD      A,(IY+0)        ; DUMMY VALUE INTO ACC.
7F20 FD7E00     00940         LD      A,(IY+0)        ; GET HOURS HIGH VALUE
7F23 F5         00950         PUSH    AF              ; SAVE THIS FOR AM/PM
7F24 14         00960         INC     D               ; ACCOMMODATE SUBROUTINE
7F25 0E03       00970         LD      C,3             ; MASK UNUSED CLOCK BITS
7F27 CDDB7F     00980         CALL    FILLER          ; GET HOURS HIGH VALUE
7F2A 0E0F       00990         LD      C,0FH           ; MASK UNUSED CLOCK BITS
7F2C CDDB7F     01000         CALL    FILLER          ; GET HOURS LOW VALUE
7F2F 363A       01010         LD      (HL),3AH        ; PUT A COLON IN TIME$
7F31 23         01020         INC     HL              ; BUMP THE STRING ALONG
7F32 0602       01030         LD      B,2             ; NUMBER MINUTE/SEC LOOPS
7F34 CDDB7F     01040 MINSEC  CALL    FILLER          ; GET,CONVERT,SAVE VALUE
7F37 CDDB7F     01050         CALL    FILLER          ; GET,CONVERT,SAVE VALUE
7F3A 363A       01060         LD      (HL),3AH        ; VALUE FOR A COLON
7F3C 23         01070         INC     HL              ; BUMP TIME BUFFER BY ONE
7F3D 10F5       01080         DJNZ    MINSEC          ; GO BACK FOR MIN/SEC
7F3F 2B         01090         DEC     HL              ; BACK UP TO LAST COLON
```

Program continues

```
7F48 3620       01100           LD      (HL),20H        ; CHANGE COLON TO SPACE
                01110 ; ********************************************************
                01120 ; HOURS, MINUTES, SECONDS ARE DONE ... NOW FIGURE AM/PM
                01130 ; --------------------------------------------------------
7F42 23         01140           INC     HL              ; BUMP TIME BUFFER BY ONE
7F43 F1         01150           POP     AF              ; GET BACK HOUR HI VALUE
7F44 CB57       01160           BIT     2,A             ; CHECK AM/PM INDICATOR
7F46 2804       01170           JR      Z,MORNNG        ; MORNING IF BIT 2 = 0
7F48 3650       01180           LD      (HL),50H        ; PUT LETTER "P" IN PLACE
7F4A 1802       01190           JR      NEXT            ; JUMP PAST LETTER A
7F4C 3641       01200 MORNNG    LD      (HL),41H        ; PUT LETTER "A" IN PLACE
7F4E 23         01210 NEXT      INC     HL              ; BUMP TIME BUFFER BY ONE
7F4F 364D       01220           LD      (HL),4DH        ; PUT LETTER "M" IN PLACE
7F51 C38428     01230           JP      2884H           ; BACK TO BASIC ACTIVITY
                01240 ; ********************************************************
                01250 ; THIS IS THE BEGINNING OF THE "CMD" PATCH TO SET TIME
                01260 ; CHECK FOR TIME SETTING PARAMETERS AND SYNTAX
                01270 ; --------------------------------------------------------
7F54 7E         01280 START2    LD      A,(HL)          ; CHAR AT LINE POINTER
7F55 FE22       01290           CP      22H             ; IS IT A QUOTE MARK?
7F57 C29719     01300           JP      NZ,1997H        ; ?SN ERROR IF NO QUOTE
7F5A 23         01310           INC     HL              ; BUMP LINE PTR. BY ONE
7F5B E5         01320           PUSH    HL              ; SAVE THE LINE POINTER
7F5C 11EA7F     01330           LD      DE,TABLE        ; GET TABLE OF DAY NAMES
7F5F 0E00       01340           LD      C,0             ; THIS WILL BE COUNTER
7F61 0603       01350 DYLOOP    LD      B,3             ; NUMBER OF CHARS IN DAY
7F63 E1         01360           POP     HL              ; GET LINE POINTER BACK
7F64 E5         01370           PUSH    HL              ; SAVE AGAIN FOR LOOP USE
7F65 1A         01380 FINDIT    LD      A,(DE)          ; GET 1ST CHAR OF STRING
7F66 A7         01390           AND     A               ; EASY WAY TO SET A FLAG
7F67 2809       01400           JR      Z,ERROR1        ; VALUE = 0 ... ?SN ERROR
7F69 BE         01410           CP      (HL)            ; CHECK IT AGAINST TABLE
7F6A 280A       01420           JR      Z,GOTONE        ; MATCH...GET NEXT CHAR
7F6C 13         01430 LOOP4     INC     DE              ; RUN PAST VALUES FOR DAY
7F6D 10FD       01440           DJNZ    LOOP4           ; BY RUNNING B TO ZERO
7F6F 0C         01450           INC     C               ; NEXT DAY - BUMP COUNTER
7F70 10EF       01460           JR      DYLOOP          ; BACK TO NEXT DAY LOOP
7F72 E1         01470 ERROR1    POP     HL              ; CLEAR STACK OF HL REG.
7F73 C39719     01480 ERROR2    JP      1997H           ; GO TO ?SN ERROR MESSAGE
7F76 23         01490 GOTONE    INC     HL              ; GET NEXT CHAR FROM LINE
7F77 13         01500           INC     DE              ; BUMP TABLE VALUE ALONG
7F78 10EB       01510           DJNZ    FINDIT          ; KEEP GOING TILL DONE
                01520 ; ********************************************************
                01530 ; NUMERICAL VALUE FOR DAY IS IN C - PUT IT IN MSM5832
                01540 ; --------------------------------------------------------
7F7A F1         01550           POP     AF              ; CLEAR STACK OF HL VALUE
7F7B FD36038B   01560           LD      (IY+3),8BH      ; SET UP 8255 TO WRITE
7F7F FD360250   01570           LD      (IY+2),50H      ; CLOCK CHIP WRITE VALUE
7F83 79         01580           LD      A,C             ; GET DAY OF WEEK VALUE
7F84 FD360106   01590           LD      (IY+1),6        ; READY TO WRITE DAY
7F88 FD7700     01600           LD      (IY+0),A        ; WRITE DAY TO CLOCK
                01610 ; ********************************************************
                01620 ; DAY IS WRITTEN - FIND MONTH, DAY, YEAR AND WRITE THEM
                01630 ; --------------------------------------------------------
7F8B 160B       01640           LD      D,11            ; VALUE FOR MONTH + 1
7F8D CDC37F     01650           CALL    TIMSET          ; WRITE MONTH TO CLOCK
7F90 CDC37F     01660           CALL    TIMSET          ; WRITE DAY TO CLOCK
7F93 160D       01670           LD      D,13            ; VALUE FOR YEAR +1
7F95 CDC37F     01680           CALL    TIMSET          ; WRITE YEAR TO CLOCK
7F98 1605       01690           LD      D,5             ; SET TO HOURS HIGH VALUE
7F9A CDA67F     01700           CALL    AMORPM          ; WRITE HOURS TO CLOCK
7F9D CDC37F     01710           CALL    TIMSET          ; WRITE MINUTES TO CLOCK
7FA0 0604       01720           LD      B,4             ; NUMBER OF CHARS LEFT
7FA2 23         01730 SNEAK     INC     HL              ; BUMP LINE POINTER
7FA3 10FD       01740           DJNZ    SNEAK           ; LOOP PAST "PM" & QUOTES
7FA5 C9         01750           RET                     ; BACK TO BASIC PROGRAM
                01760 ; ********************************************************
                01770 ; CHECK FOR AM OR PM INDICATION AND WRITE THAT VALUE
                01780 ; --------------------------------------------------------
7FA6 23         01790 AMORPM    INC     HL              ; BUMP LINE TO NEXT CHAR.
7FA7 E5         01800           PUSH    HL              ; SAVE CURRENT LINE PTR.
7FA8 D5         01810           PUSH    DE              ; SAVE OTHER VALUES IN DE
7FA9 110600     01820           LD      DE,6            ; HOW MANY SPACES TO MOVE
7FAC 19         01830           ADD     HL,DE           ; FIND AM OR PM IN LINE
7FAD 7E         01840           LD      A,(HL)          ; GET CHARACTER FROM LINE
7FAE FE41       01850           CP      41H             ; SET FLAG IF CHAR. = "A"
7FB0 3E04       01860           LD      A,4             ; GET PM INDICATOR READY
7FB2 2001       01870           JR      NZ,EVENNG       ; ZERO FLAG NOT SET IF PM
7FB4 AF         01880           XOR     A               ; CLEAR PM INDICATOR
7FB5 D1         01890 EVENNG    POP     DE              ; RESTORE VALUES TO DE
7FB6 E1         01900           POP     HL              ; GET ORIGINAL LINE PTR.
7FB7 0602       01910           LD      B,2             ; SET UP B AS TIMSET LOOP
7FB9 4F         01920           LD      C,A             ; SAVE AM/PM INDICATOR
7FBA 7E         01930           LD      A,(HL)          ; GET VALUE FROM LINE
7FBB D630       01940           SUB     30H             ; STRIP ASCII MASK
7FBD 3003       01950           JR      C,ERROR1        ; ERROR IF LESS THAN 0
7FBF 81         01960           ADD     A,C             ; ADD AM/PM BIT TO VALUE
7FC0 C3CD7F     01970           JP      MIDDLE          ; SUBROUTINE FINISHES JOB
                01980 ; ********************************************************
                01990 ; TIME SETTING SUBROUTINE CHECKS LINE FOR SYNTAX
                02000 ; --------------------------------------------------------
7FC3 1E30       02010 TIMSET    LD      E,30H           ; CONVERTS ASCII TO HEX
7FC5 0602       02020           LD      B,2             ; LOOP TWICE FOR 2 DIGITS
7FC7 15         02030 ZLOOP     DEC     D               ; BUMP CLOCK ADDRESS PORT
7FC8 23         02040           INC     HL              ; GET NEXT CHAR FROM LINE
7FC9 7E         02050           LD      A,(HL)          ; MOVE IT TO ACC. TO TEST
```

Program continues

Both TIME$ and CMD are "Level III" or DOS (disk operating system) commands, so called because, although Level II acknowledges them (with an ?L3 ERROR message), they have been reserved for system software expansion. What that means is that there is a memory patch point for each of them.

In normal Level II BASIC, that patch point command effectively is "jump to the ?L3 ERROR message". We change that in this program—see lines 190 to 230—by patching into TIME$ at address 4177 hex, and into CMD at address 4174.

When we now issue a command such as PRINT TIME$, the program jumps to the linking point at 4177, and is re-routed to our own time program beginning at address 7EB6. (If you use an editor/assembler, this program may be relocated to any convenient address).

The IY register is assigned to the clock's allocated memory position (37D0), and, just as in the BASIC listing, the port and clock are prepared for reading. There is a CALL into a subroutine in ROM (line 310), which sets all the necessary pointers to create a 24-character string for BASIC's use.

Take a look at the redundant instructions at lines 440 and 450. Because the clock chip is slow, we read the same information twice to give the signals time to stabilize through the 8255 port device. The clock requires a set-up time of about six microseconds, so if your TRS-80 is modified for high speed, you may have to triple this instruction to get a reliable value from the clock.

Corresponding Day

Lines 460 through 650 look up the corresponding day of the week in the table found at lines 2300 and following. The program then goes on (lines 690 to 1100) to read each value from the clock, convert it to ASCII characters, and build a string for display or printing.

The morning/afternoon part of the string is created at lines 1140 to 1220, and finally the program jumps into ROM at address 2884, which completes the interpretation of the user's BASIC command, directing the TIME$ to print, line print, equate with another string, etc.

To set the time, a format similar to the display must be used. In other words, when you command PRINT TIME$, the screen might read:

```
MON 02/26/80 11:05:16 AM
```

In setting the time using CMD, it is enclosed in quotes, leaving off only the value

for seconds, as in this sample:

```
CMD"TUE 03/14/49 02:29 PM"
```

The quotes, spaces, punctuation, and leading zeros must be intact as shown or e ?SN ERROR will result.

The TRS-80 reads all this information by branching to the address 4174 hex, which would ordinarily produce a Level III error (?L3 ERROR) in response to "CMD". Instead, we redirect it to our routine at 7F54 (line 1280 in the listing). The syntax is verified for the quotation mark, and the table of days of the week is checked for a match to the day you have entered (remember not to use shifted characters).

Each succeeding character is read, validated, and sent out to the clock chip. Almost all the subroutines are identical, except for the one which identifies AM or PM.

Finally, the program executed a RETurn, which sends it back to the program or command routine in progress. The TIME$ and CMD statements can be used in a program or from the command mode; they can now act exactly like any other standard Level II BASIC instructions.

Next month the use of the interrupt-driven real-time clock circuit will be presented. In its place (in order to keep my telephone from ringing off the wall!), are a few of the more important missing photographs of the six TRS-80 modifications described in September's Applications.■

Add a Keyboard

Photo 1. Slide one of the wire wrap sockets into the disembowelled solder-tail socket. Photo 2. Feed the wire-wrap pins through the circuit board and fasten the sockets with fast drying glue.

```
7FCA 93         02060           SUB     E               ; STRIP OFF ASCII VALUE
7FCB 38A5       02070           JR      C,ERROR1        ; ERROR IF LESS THAN 0
7FCD FE0A       02080 MIDDLE    CP      0AH             ; CHECK IF GREATER THAN 9
7FCF 30A1       02090           JR      NC,ERROR1       ; ERROR IF GREATER THAN 9
7FD1 FD7201     02100           LD      (IY+1),D        ; OPEN PORT TO CLOCK
7FD4 FD7700     02110           LD      (IY+0),A        ; WRITE VALUE TO CLOCK
7FD7 10EE       02120           DJNZ    ZLOOP           ; DO IT FOR 2 DIGITS
7FD9 23         02130           INC     HL              ; BUMP PAST / : OR SPACE
7FDA C9         02140           RET                     ; BACK TO MAIN PROGRAM
                02150 ; ********************************************************
                02160 ; GET VALUE, CONVERT TO ASCII, AND SAVE IN TIME$ BUFFER
                02170 ; --------------------------------------------------------
7FDB 15         02180 FILLER    DEC     D               ; BUMP CLOCK PORT ADDRESS
7FDC FD7201     02190           LD      (IY+1),D        ; POINT TO VALUE WANTED
7FDF FD7E00     02200           LD      A,(IY+0)        ; GET DUMMY VALUE INTO A
7FE2 FD7E00     02210           LD      A,(IY+0)        ; NOW GET VALID VALUE
7FE5 A1         02220           AND     C               ; MASK UNUSED BITS
7FE6 83         02230           ADD     A,E             ; MAKE IT AN ASCII VALUE
7FE7 77         02240           LD      (HL),A          ; PUT VALUE INTO BUFFER
7FE8 23         02250           INC     HL              ; NEXT BUFFER POSITION
7FE9 C9         02260           RET                     ; BACK TO MAIN PROGRAM
                02270 ; ********************************************************
                02280 ; THIS IS THE LOOKUP TABLE OF DAYS OF THE WEEK
                02290 ; --------------------------------------------------------
7FEA 4D         02300 TABLE     DEFM    'MON'
                02310 ;
7FED 54         02320           DEFM    'TUE'
                02330 ;
7FF0 57         02340           DEFM    'WED'
                02350 ;
7FF3 54         02360           DEFM    'THU'
                02370 ;
7FF6 46         02380           DEFM    'FRI'
                02390 ;
7FF9 53         02400           DEFM    'SAT'
                02410 ;
7FFC 53         02420           DEFM    'SUN'
                02430 ;
7FFF 00         02440           DEFB    0
                02450 ;
                02460 ; ********************************************************
7EA7            02470           END     ENTRY
00000 TOTAL ERRORS


AMORPM 7FA6 01790   01780
DYLOOP 7F61 01350   01460
ENTRY  7EA7 00190   02470
ERROR1 7F72 01470   01480 01950 02070 02090
ERROR2 7F73 01480
EVENNG 7FB5 01890   01870
FILLER 7FDB 02180   00730 00740 00780 00800 00840 00850 00900
                    01000 01040 01050
FINDIT 7F65 01380   01510
GOTON1 7F76 01490   01420
LOOP1  7EDC 00490   00540
LOOP2  7EE1 00520   00530
LOOP4  7F6C 01430   01440
MIDDLE 7FCD 02080   01970
MINSEC 7F34 01040   01080
MORNNG 7F4C 01200   01170
NEXT   7F4E 01210   01190
SNEAK  7FA2 01730   01740
START1 7EB6 00280   00190
START2 7F54 01280   00210
TABLE  7FEA 02300   00470 01330
TIMLET 7FC3 02010   01650 01660 01680 01710
XLOOP  7EE6 00500   00500
YLOOP  7FEB 00590   00630
ZLOOP  7FC7 02030   02120
```

Program Listing 2. CLock program for MSM5832 Board attached to the TRS-80 at address 14288 to 14291, using "Times" and "CMD".

Photo 3. Piggyback the remeining wire-wrap socket into the first one and snap the cover back on.

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Photo 4. Socket should fit 1/16 of an inch above the surface of the cover.

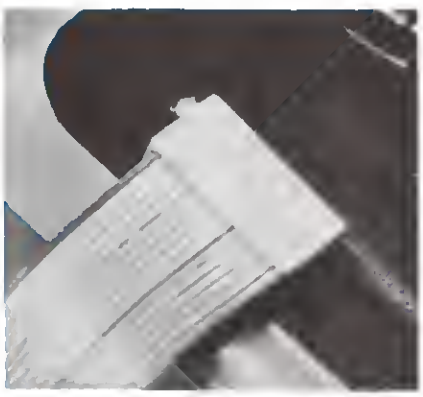

Photo 5. Cable plugs comfortably away from keycaps.

Return to Level I BASIC

Photo 1. Line up the two chips piggyback and solder all 24 pins.

Parts list for Kitsz's October Column

IC	TYPE	Vcc	GND
Z1	78L05	3	2
Z2	74LS14	14	7
Z3	74LS90	5	10
Z4	74LS92	5	10
Z5	74LS74	14	7

Real time clock using one second interrupt

IC	TYPE	Vcc	GND
ZA	74LS27	14	7
ZB	74LS04	14	7

Real-time clock using MSM5832 alternate circuit to replace 74LS260

IC	TYPE	Vcc	GND
Z1	74LS30	14	7
Z2	74LS260	14	7
Z3	INS8255	26	7
Z4	MSM5832	1	13

XTAL 32768 Hz
R1-R12 10K
C1, C2 20 pf
C3-C5 1 uf

Z3
NOT CONNECTED
14, 15, 16, 17
22, 23, 24, 25
37, 38, 39, 40

Real time clock using MSM5832 clock/calendar

	DEVICE	R.S. PART NO.
T1	6.3V 1A transformer	273-050
D1	Bridge rectifier 1A 50V	276-1161
C6	470 uf 16V	272-1018
C7,C9	10 uf 10V	272-1013
C8	1 uf disc	272-135
R13	47K 1/4W	271-042
R14,R15	10K 1/4W	271-034
R16	100Ω 1/2W	271-012
Q1	PNP xtor V_{CE} = 1V	276-2021
Q2	NPN xtor	276-2033
Z5	7805 5-volt regulator	276-1770
D2	Diode 1A 50V	276-1101

Power Supply with Battery Backup for MSM5832 clock

THE ASSEMBLY LINE

by William Barden, Jr.

This month I'm going to answar the questions many disk usare heve bean asking: How do I talk to tha disk by tha TRSDOS calls? How can I bypass TRSDOS and talk directly to the disk? Yas, assemblers, this month's column is devotad to disk usars. If you don't hava a disk, I'll wait until you rush to town and buy one(. . . I'll just load this cassatta file whlia you're making tha purchasa . . .).

Disk Basics

By now you've purchased your disk, pluggad it in, and are raady to go. Let's look at a faw disk basics. Soma of these points may ba obvious to a lot of you, so plaase bear with me as I start from tha vary beginning.

Tha beginning is a circular pieca of mylar coated with a ferro-magnetic material. Each disketta is certified by the manufacturar by writing and verifying high-denelty date. In most casas, this cartification procedure is much mora stringant than tha bit dansities ancounterad in TRS-80 usa. This explains why many usars gat away with making thair own "flippias," cutting naw indax holes and write-protact notches on the opposita aida of the diskette uea the sacond sida. (I do it myself with no problams.)

You all know tha physical layout of the diskettes. Tha indax hole marks tha baginning of sector 0 in tha TRS-80 soft-sactorad format. (In the hard-sactored format thara is an index hola for aach sactor.) Tha write-protact notch, of coursa, inhibits writing when covered with tapa.

An important point, which may not be obvious to avaryona: As the diskatta comes from the manufacturar, it is unformattad. Thara is no data, other than random data, on the diskatta. Thare are no inherent magnetized marks that indicate sactors, tracks, or any othar araas on tha disketta.

To ba usad, aach disketta must ba formatted. This simply means that idantification data is writtan on aach of 35 (or 40 or 77) tracks on the diskatta. The identitication data includes gaps for 256 bytes of usar data in aach sector. Standard TRS-80 diskettas are 35 tracks of 10 sectors aach. Tha formatting procass is handled by a formatting program that talks in assembly ianguaga to tha 1771 disk controilar chip in the expansion intertaca. Tha formatting program sands spacial codes to the disk controiler chip to causa track/sector identification marks, data address merks, and CRC (check) characters to ba writtan in tha propar placas (Fig. 1).

Tha layout of the standard TRSDOS disketta is shown in Fig. 2. Tha first 256 bytes of track 0, sector 0 ot the diskatta ara dadicatad to a bootatrap program callad BOOT/SYS. This bootstrap is raed into RAM at 4200 by the Lavel II initialization code. Tha initialization coda raads back status from tha disk. If there is indead a disk out thera, it raads in track 0, sector zaro. Tha bootstrap pulls in the remaindar of TRSDOS.

The directory of TRSDOS is locatad in track 17 (physically halfway through tha tracks). It occupies tha antira track, and

contains a grenule allocation table (GAT—sector 0), hash index table (HIT—sector 1), and directory of file nemee (remaining eight sectors). The directory contains the nemes of ell disk files. All additions of new files, modifications of existing files, deletions of files, and so forth, is done by first searching the directory for the file neme, or meking e new entry of the file neme. File nemes ere in stendard TRS-80 format - one - eight character name, extension, password, disk drive number, and Socie! Security number.

Disk files are made up of any number of granules. Each granule is five sectors, or one-half track worth of disk. Why five sectors?

Five sectors is 1280 bytes, a not unreasoneble size for program chunks or meaningful quantities of data. I suspect one of the reasons for this disk allocation is that it's simply easier to work with 70 segments rether than 350 segments (sectors) of disk resource—it makes the file management routines less complicated, and cute down on the size of directory spece.

Now let's esk ourselvee a philosophical question...Why this structure? Why not a directory on treck 0? Why not 250 segments to be allocated one at a time? Why passwords) Why not? That's the design that was implemented, and it's not bad. If you want to use TRSDOS, you must accept the existing structure—well, almost...

Two Alternatives: How do You Manage?

Knowing something about the TRSDOS structure at this point, the disk user is faced with two alternatives. One is to use the built-in file management routines of TRSDOS and Disk BASIC to store end retrieve files of data. This is not a bad choice; we can easily initiate, write, read and verify sequential or random files in assembly language. What we cannot do in this structure, however, is get at other ereas of the disk—investigate the directory, bootstrep, SYS files, and so forth.

The second alternative is to scrap the TRSDOS structure and write your own assembly language file manegement routines to create, write, read end perform other operations on files. You can create your own file structure on disk, or even meke one compatible with TRSDOS. However, to do this, you must gain experience in two areas.

First of all, you must know how to talk to the disk controller chip directly. The Western Digitel FD-1771 chip is a small microprocessor in itself, dedicated to controlling floppy disk functions. It has a set of 11 commands and e number of internal registers that control sequences of operations euch es writing e sector, reading e sector, stepping the head in end out, writing and reading tracks, and so forth. Because of the complexity of the chip, we can't cover the operations here.

Secondly you must know something about disk file management design. Your application may be as simple es storing date on the disk from track 0, sector 0 through track 34, sector 9; it may also be e lot more complex, euch as implementing a time-shering application or virtual memory. Here again, there is too much material to be covered even in several columns.

If you would like to know more about implementing your own disk file management and disk I/O drivers, here's the plan of etteck: Get a copy of the FD-1771 Floppy Disk Controller/Formatter specification from Western Digital. It will list all commands, status, and disk operations. Then type some simple experimentation using essembly language. You can't hurt the disk, but I would advise using a diskette other then your company's payroll master.

If you haven't become e blithering idiot after that, do some reading on file menagement and stert coding your own designs. The advantages? You could conceivebly eetablish a much tester, more efficient storage scheme, geared to your own application.

For the remainder of the column we'll look at the second option, using the TRSDOS I/O calls to handle TRSDOS compatible files. Although we have to work within the framework of TRSDOS, we can still do some neat things.

Physical Records vs. Logical Records

Suppose you need an article cross-reference file containing titles and pertinent information on computer magazine articles. If you establish that each record of the file can be held in 64 bytes, the record definition is called the logical record of the file; it's the record that the program will be processing end listing out.

When writing records to disk, four 64-byte records must be blocked into 256-byte chunks. The reeson for this is that all disk operations are done on a sector basis. The sector records are called physical records, since they describe the length of the actuel physical record, just as a punched cerd (sey wha') would be one physical record of 80 bytes.

Much of the work of TRSDOS file management is concerned with blocking the user specified logical records into sector sized physical records on writes, and deblocking the logical records on reads. To do this, TRSDOS reads and writes sector

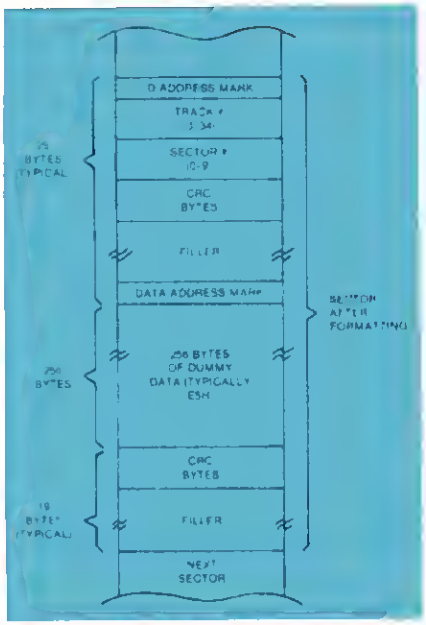

Fig. 1. Disk Formatting

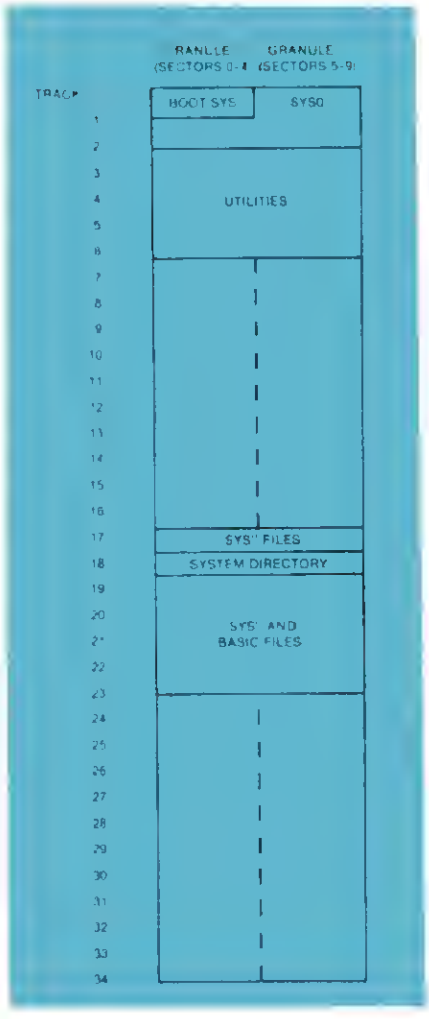

Fig. 2. TRSDOS Disk Layout

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records from a user specified 256-byte buffer. In Disk BASIC, the buffers are dedicated memory areas. In assembly language calls to the TRSDOS I/O routine, the user may specify any memory area as the buffer.

Device Control Blocks

TRSDOS I/O calls are made by passing the address of a device control block (DCB) in the DE register pair. The DCB is a 32-byte block anywhere in user memory that contains a standard TRSDOS type file name (don't forget your Social Security Number).

The contents of the DCB are used to find or initiate the disk file. The file name string is then clobbered, and the 32-byte area is used as working storage for the disk file activity. After the file operations are completed, the file name is restored. The appearance of the DCB is shown in Fig. 3, both in file name and working storage formats. Why does TRSDOS use the DCB instead of maintaining working variables somewhere within the depths of itself next to the mysterious F3GUM or RVCOOK? Don't complain—the DCB defines an area that the user can access to look at the parameters as file operations are performed.

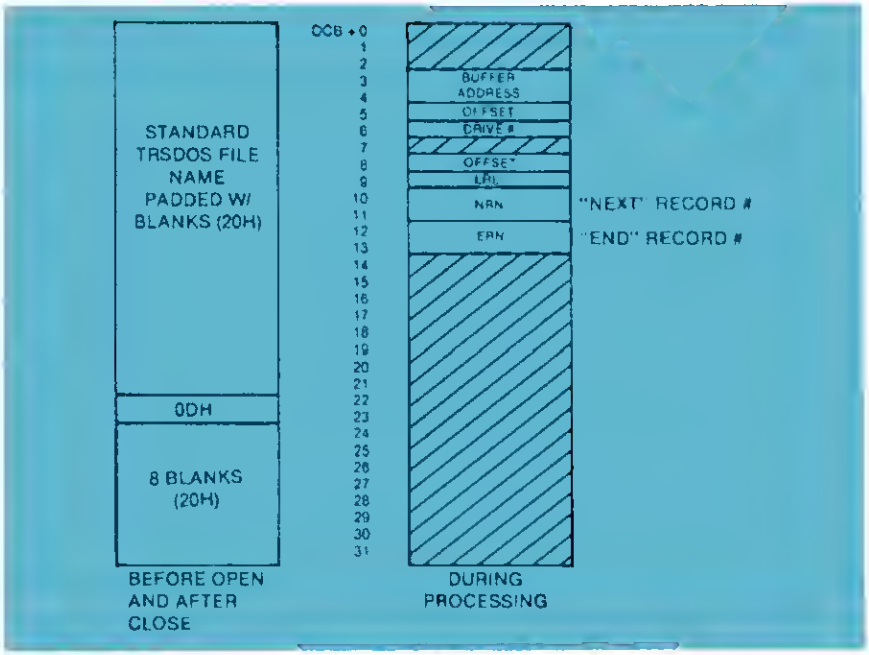

Fig. 3. DCB Format

Let's get to the actual disk calls in the TRSDOS area themselves. (Sorry about the programmer in Des Moines who fell asleep reading this introductory material.) There are eight calls. (They are described in the *TRSDOS/Disk BASIC Reference Manual*.) Each call is to a TRSDOS routine at about 44XXH:

- INIT Creates a new file entry in the directory.
- OPEN Finds an old file entry and starts operations.
- READ Reads a logical record from an existing file.
- WRITE Writes a logical record to an INITialized or OPENed file.
- POSN Positions causes TRSDOS to find a random record.
- VERF is the same as WRITE, except that the data is read back and compared.
- CLOSE Terminates operations on the file.
- KILL Deletes a file from the directory and releases its space.

Creating a File

The normal sequence of calls for creating a new file is to call the INIT routine to create a new file entry, make a series of WRITE calls, and then CLOSE the file. The CLOSE call is very important, as it writes an end of file and closes file operations in an orderly fashion. Not using the CLOSE might result in data still in the buffer and not written out to disk.

The INIT call is made with DE pointing to the DCB, HL pointing to any 256-byte buffer area in RAM, and the B register containing the length of the logical record. This LRL may be one to 255, for lengths of one to 255 bytes. If a zero is used, the record will be made 256 bytes, or one sector in length.

```
LD      HL,BUF1     ;LOAD BUFFER LOCATION
LD      DE,DCB      ;DCB LOCATION
LD      B,64        ;LRL OF 64 BYTES
CALL    4420H       ;CALL INIT
JR      NZ,ERROR    ;GO IF ERROR
```

Note that on the return the Z flag is set if everything went as planned. However, if the Z flag is not set (NZ condition), a TRSDOS disk error occurred, and some type of error action must be taken. The error may be anything from a write-protected disk to a hard disk error. There's a list of error codes in your TRSDOS/Disk BASIC Reference Manual together with corrective action.

After the file has been INITialized, a series of WRITES can be done. The WRITE call is made with DE pointing to the DCB (which now contains variables such as the LRL). The HL register pair contains the User Record Area address or UREC. This is the location of your logical record. The WRITE causes your logical record to be physically transferred from the UREC to the BUFFER. Only when the BUFFER is filled to capacity is a disk sector write made for the file. In the case of 64-byte logical records, this means a write every four logical records.

```
LD      HL,MYREC    ;LOAD ADDRESS OF
                    64-BYTE REC
LD      DE,DCB      ;DCB LOCATION
CALL    4439H       ;CALL WRITE
JR      NZ,ERROR    ;GO IF ERROR
```

A VERF write reads back every sector after a write to disk and compares it with the contents of the buffer. The setup is the same as the WRITE, but the call is made to location 443CH. I'd recommend the VERF in place of a WRITE, as the overhead is not all that great.

Each successive WRITE automatically writes a record in the next position in the file, creating a sequential file. After all the necessary writes have been done, a CLOSE operation terminates the disk file. Since there may be a partial BUFFER that has not been written out, and since other TRSDOS actions must be taken to close the file, the CLOSE is absolutely necessary.

```
LD      DE,DCB      ;LOAD DCB ADDRESS
CALL    4428H       ;CLOSE FILE
JR      NZ,ERROR    ;GO IF ERROR
```

Reading an Existing File

The normal sequence of calls for reading an existing file is to call the OPEN routine so that TRSDOS can locate the file, then make a series of READ calls to read logical records into the User Record Area,

and then to CLOSE the file.

The OPEN routine call is identical to the INIT except for the CALL location. (By the way, almost all TRSDOS files have LRL = 0 (256 bytes) so use this value if reading existing TRSDOS files.)

```
LD      HL,BUF1     ;LOAD BUFFER LOCATION
LD      DE,DCB      ;DCB LOCATION
LD      B,64        ;LRL OF 64 BYTES
CALL    4424H       ;CALL OPEN
JR      NZ,ERROR    ;GO IF ERROR
```

After a successful OPEN (Naturally there is an error code for non-existent files), a READ call can be made to read the physical record into the User Record Area. This will physically transfer a record from the BUFFER to the user specified UREC but will result in a disk sector read only if the last logical record in the BUFFER has been transferred. In the 64-byte LRL case, every four READ calls will result in a new disk sector read.

```
LD      MYREC       ;LOAD ADDRESS OF
                    64-BYTE BUFFER
LD      DE,DCB      ;DCB LOCATION
CALL    4436H       ;CALL READ
JR      NZ,ERROR    ;GO IF ERROR
```

Successive READs will transfer the next logical record from the file into the UREC automatically, reading a sequential file without the user having to specify which record is required. After a series of READs, a CLOSE is done as in the WRITE case to properly terminate the disk file action. The calling sequence is the same.

Random Files

The above sequences show how to WRITE and READ sequential disk file. The only difference in operating with random files is that the user must specify the record to be transferred, rather than letting TRSDOS simply pick up the next sequential record or write the next record in sequence.

In random files, a POSN call precedes every READ or WRITE. The POSN call positions TRSDOS to the random record required. This step is necessary because the chances are good that the random record is not in the current BUFFER on a READ, or could not be placed in the BUFFER on a WRITE. In the POSN call, DE is loaded with the DCB location as in the other calls, but BC contains a logical record number for which TRSDOS is to search and position. A typical sequence to read the 15th record of a file after an OPEN would be:

```
LD      DE,DCB      ;DCB LOCATION
LD      BC,14       ;15th RECORD
CALL    4442H       ;POSN CALL
JR      NZ,ERROR    ;GO IF ERROR
LD      HL,MYREC    ;LOAD ADDRESS OF
                    64-BYTE RECORD
LD      DE,DCB      ;DCB LOCATION
CALL    4436H       ;READ RECORD
JR      NZ,ERROR    ;GO IF ERROR
```

A DUMP Program

To tie all of these concepts together I've written a short program that will dump out a given area of memory as a disk file of 64-byte logical records. It also has the ability to read in the records. This is somewhat more general purpose in nature than the TRSDOS DUMP command, as it does not assume that the data in memory is machine language. A good test case for its use is to dump out the video display memory area and then to read it in again.

Next month we'll present the results of the Third Assembly Line Programming Contest, provided that I'm not getting dozens of entries by the article deadline. (I just got a high speed multiply routine today for the second contest that looks like it does the job in 145.99 microseconds! 145.98 anyone?)

```
FE00                00100          ORG     0FE00H
                    00110 ;*************************************************
                    00120 ;*                 DUMP/READ SUBROUTINE          *
                    00130 ;* DUMPS  MEMORY TO DISK AS 64 BYTE LOGICAL RECORD FILE. *
                    00140 ;* READS BACK IN FILE, FILE NAME 'ALINE'         *
                    00150 ;*************************************************
                    00160 ;
                    00170 ;***ENTER HERE FOR DUMP WITH HL=START, DE # BYTES***
                    00180 ;***DE MUST BE TO NEXT 64 BYTE BOUNDARY, DE =16*  ***
FE00 0606           00190 DUMP      LD      B,6             ;ITERATION COUNT
FE02 CD6DFE         00200 DMP010    CALL    SHIFT             ;DIVIDE # BYTES BY 64
FE05 10FB           00210           DJNZ    DMP010            ;LOOP 'TIL D=0
FE07 D5             00220           PUSH    DE              ;SAVE # OF RECORDS TO WRITE
FE08 ED5392FE       00230           LD      (NOREC),DE      ;SAVE FOR READ
FE0C E5             00240           PUSH    HL              ;SAVE START
FE0D 2194FE         00250           LD      HL,BUFFER       ;BUFFER START
FE10 1172FE         00260           LD      DE,DCB          ;DCB ADDRESS
FE13 0640           00270           LD      B,64            ;64 BYTE LRL
FE15 CD2844         00280           CALL    4428H           ;INITIALIZE FILE
FE18 2808           00290           JR      Z,DMP020        ;GO IF NO ERROR
FE1A F600           00300 DMP01.    OR      00H             ;ERROR CODE IN A
FE1C CD0944         00310           CALL    4409H           ;ERROR DISPLAY ROUTINE
FE1F CD2D40         00320           CALL    402DH           ;TO BOOT
FE22 E1             00330 DMP020    POP     HL                ;GET USER REC AREA (MEMORY)
FE23 E5             00340           PUSH    HL                ;SAVE
FE24 1172FE         00350           LD      DE,DCB            ;DCB ADDRESS
FE27 CD3C44         00360           CALL    443CH             ;WRITE
FE2A 201E           00370           JR      NZ,DMP015         ;GO IF ERROR
FE2C E1             00380           POP     HL                ;RESTORE REGS
FE2D D1             00390           POP     DE                ;RESTORE COUNT
FE2E 1B             00400           DEC     DE                ;DECREMENT CNT OF RECORDS
FE2F 7A             00410           LD      A,D               ;GET MS BYTE OF COUNT
FE30 B3             00420           OR      E                 ;TEST FOR ZERO
FE31 2808           00430           JR      Z,DMP090          ;GO IF DONE
FE33 014000         00440           LD      BC,64             ;INCREMENT FOR UREC
FE36 09             00450           ADD     HL,BC             ;POINT TO NEXT BLOCK
FE37 D5             00460           PUSH    DE                ;SAVE REGS
FE38 E5             00470           PUSH    HL
FE39 18C7           00480           JR      DMP020          ;CONTINUE
FE3B 1172FE         00490 DMP090    LD      DE,DCB          ;DCB ADDRESS
FE3E CD2844         00500           CALL    4428H           ;CLOSE
FE41 20D7           00510           JR      NZ,DMP015       ;GO IF ERROR
FE43 C9             00520           RET                     ;RETURN
                    00530 ;***ENTER HERE FOR READS OF "ALINE", (HL)=START ADDY ***
FE44 E5             00540 READ      PUSH    HL              ;SAVE START
FE45 2194FE         00550           LD      HL,BUFFER       ;BUFFER ADDRESS
FE48 1172FE         00560           LD      DE,DCB          ;DCB ADDRESS
FE4B 0640           00570           LD      B,64            ;LRL=64 BYTES
FE4D CD2444         00580           CALL    4424H           ;OPEN
FE50 20C8           00590           JR      NZ,DMP015       ;GO IF ERROR
FE52 E1             00600 RFA010    POP     HL                ;GET ADDRESS FOR UREC
FE53 E5             00610           PUSH    HL                ;SAVE
FE54 1172FE         00620           LD      DE,DCB            ;DCB ADDRESS
FE57 CD3644         00630           CALL    4436H             ;READ ONE LOGICAL REC
FE5A 20B8           00640           JR      NZ,DMP01'         ;GO IF ERROR
FE5C 3A92FE         00650           LD      A,(NOREC)         ;GET # TO READ
FE5F 3D             00660           DEC     A                 ;DECREMENT
FE60 3292FE         00670           LD      (NOREC),A         ;SAVE
FE63 28D6           00680           JR      Z,DMP090          ;RETURN IF DONE
FE65 E1             00690           POP     HL                ;GET UREC POINTER
FE66 014000         00700           LD      BC,64             ;# OF BYTES IN REC
FE69 09             00710           ADD     HL,BC             ;FIND NEW ADDRESS
FE6A E5             00720           PUSH    HL                ;SAVE
FE6B 18E5           00730           JR      READ10            ;LOOP ON READ
FE6D CB3A           00740 SHIFT     SRL     D               ;SHIFT D TO CY
FE6F CB1B           00750           RR      E               ;DOUBLE SHIFT OF DE
FE71 C9             00760           RET                     ;RETURN
FE72 41             00770 DCB       DEFM    'ALINE'
FE89 0D             00780           DEFB    0DH             ;MUST BE RETURN HERE
FE8A 20             00790           DEFM    '
0002                00800 NOREC     DEFS    2               ;ONLY ONE USED
0100                00810 BUFFER    DEFS    256             ;BUFFER USED FOR SECTOR
0000                00820           END
00000 TOTAL ERRORS
```

Program Listing 1

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80 REVIEWS

"Throughout can be found several methods to faster graphics, searching, and sorting—all which provide aid to those speed-oriented programmers."

Programming Techniques for Level II BASIC
William Barden, Jr.
Tandy/Radio Shack
Softcover
$4.95

by Tom Yager

Radio Shack's latast venture into the world of publishing is a book which tries to teach the TRS-80 user some of the more advenced techniques used in programming. Covering everything from simple debugging to complicated sorts and tape I/O, *Programming Techniques for Level II BASIC* can enhance the work of both amateurs and experts.

The book, which contains twelve chapters, is arranged in the author's usual self-teaching style. It is assumed in the first chapter that the reader has at least a nodding acquaintance with Level II BASIC, but tha text is moat certainly not aimed at the experienced programmer. Those who fall into this category, however, would not be unwise to read this guide—many chapters would be of interest to any programmer concerned with conservation of time and memory.

Barden's intent is to uncover some unusual applications for the Laval II. Such applications certainly can't be found in the Level II refarence manuel. In fact, the book is less a handbook of technique than it is a handbook of well-documented applications.

Tha first chaptar lays the groundwork for the rest of tha book by giving the readar more explicit dascriptions of Level II functions than presented in the reference manual. This chapter also covers some basic programming methods which are utilized in later chapters.

Perhaps the greatast attantion in this book is paid to increased efficiency. Throughout can be found several methods to faster graphics, searching, and sorting—all which provide aid to those speed-oriented programmers.

The reader is taken through a series of applications, each a bit more involved than the one befora it, and all of them are linked together one way or enother. Barden's writing style—one which mixes wit and humor with instruction—helps keep the reader's attention, but can be tedious at times. A quick browse through the table of contents gives a hint to the tone of the entire work—which seems to be riddled with puns and jokes and is seldom serious. I'm afraid this may keep some from purchasing an otherwisa excellent book.

Among the book's many merits is that it's extremely easy to understand. Most of the text is followed closely by actual examples, many of which combine several advanced methods and provide the reader with a better understanding of not only the material at hand, but also how the current concept can be worked in with others.

One of the best chapters in the book deals with high-speed searching and sorting of data. Barden outlines several methods of accomplishing these fearful tasks, finally leading up to the fastest and most efficient. His descriptions are clear, and his examples are excellent illustrations of the material. Imagine a 1000-element mailing list that doesn't take all night to sort....

Toward the and of tha book is another interesting chapter that made me wonder if Radio Shack's usual editor went on vacation prior to this book's release. Remember those pages in the reference manual which tiptoe around such mundane things as variable storege and interfacing BASIC with machine language? These items are described much more clearly and in greater detail in Barden's book. Earlier on we even get a rundown of the TRS-80's number system.

Although I can't honestly say this book has it all, I can say that it would be to any programmer's advantage to use the techniques set forth in it. A special invitation goes out to those in the business of writing programs for others—you would do well to use the methods in this book in your software, especially if it's business-oriented. I have seen several high-priced software packages that might come near being worth their price, had they made better use of the Level II's features.■

The Most Popular Subroutines in BASIC
Ken Tracton
TAB Books
Summit, PA
Softcover, 182 pages,
$5.95

by Carroll M. Grigsby

I was ripped off! Glancing through this book in a bookstore I saw a way to generata predictabla random numbers.

Unfortunately, I failed to examine tha rest of the book very closely. Only after I paid for it did I realize that it may be the worst value available in today's personal computing market. It is a slipshod effort, tilled with errors and obviously produced in hasta. I write grocery lists with mora care.

Tha title should hava warned me. Is there a Top-40 chart for BASIC subroutines?

I will dismiss the word "most" as advertising puffery and quote from the blurb on the rear cover: "Hera's an undarstandabla guide to the BASIC subroutine...and how you can usa it on any floating point BASIC integrator (sic) or computer to avoid tedium, economize on computer time, and maka your programs run fastar."

Are "integrators" a stranga and wonderful new mix of interpreters and compilers?

White Meat or Dark?

Let me turn your attention to the maat of this turkey. In Chapter One tha reader is told that the line numbers used in the examplas can be altared without harm; from

this I presume that the target reader is a beginner. But in the next paragraph, the reader is cautioned that "altered variables" may cause problems. Yet no definition is given of "altered variables." This is not fair to the poor neophyte, who might not know what an "altered variable" is.

The author then explains that there is a price to be paid for the more compact programs that result from the use of subroutines: slower execution. The author is wrong; programs can execute more quickly if they incorporate intelligently designed subroutines.

One of the major shortcomings of the book is that most of the examples given are trivial. I concede that examples in which the computation is very simple are an effective way of illustrating a principle. But that is not the case here, where most of the examples are two or three lines in length.

The examples don't illustrate how subroutines are used to improve the quality of programs. It is possible for a beginner to get the impression that subroutines are limited to only a few lines of code, which is not correct. Many BASIC dialects permit multiple RETURN statements, yet no mention is made of this.

Other notable omissions include the DEF FN statement, and a discussion of techniques for passing variables between the calling program and subroutine.

Each of the chapters purports to give subroutines related to some technical field. But are they of any real value to someone who is interested in that field? I think not.

The chapter on measurement conversions for example, tells us that Angstrom units are converted to nanometers by multiplying by 0.1. I would think that anyone who was writing computer programs involving these units would be well aware of this fact.

For reasons known only to the publisher and author, either the book was not proofread by anyone, or else the proofs were reviewed by a technical illiterate, resulting in numerous mistakes. Examples include saying that another unit for pressure is mm Hz (Hertz is used for frequency; mercury is used in barometers); and that light intensity may be measured in foot-lambers (try foot-lamberts). At least four of the examples given will cause an error, either because of syntax or logic.

Chapter Three, "Conversion," accounts for over one-quarter of the book's size, more than its share of errors and very little utility. It could have been condensed to about five pages by using a general purpose subroutine.

Chapter Six discusses graphing. The author uses a non-standard BASIC function called SUBSTR(G$,X,1). It appears to be similar to the Microsoft MID$(G$,X,1) and is available on the CDC-CYBER computer which Tracton used to test the subroutines in the book. But it does not appear in David Lien's useful *The BASIC Handbook*.

The greatest variation among the various BASIC dialects seems to be in the area of string functions. In a more professionally done book, there would be an explanation of how the SUBSTR(G$,X,1) works. To his credit, the author does explain that there are variations in the requirements for dimensioning string variables.

Chapter Eight discusses moments of inertia. The author confuses the area moment of inertia and the mass moment of inertia in his introductory remarks. The area moment is used, among other things, to compute the deflection of a structural beam, whereas the mass moment might be used to calculate the angular acceleration of a wheel. The subroutines presented refer only to the area moment of inertia.

Several Alternatives

The next few chapters are short and of no better quality than the earlier ones. Errors abound and opportunities to give the reader some real information are missed. Sorting is called sequencing. The random number generator doesn't (at least in the version of Microsoft 8K BASIC on my Sorcerer).

Chapter 17, the closing chapter, can help the beginning programmer. It contains several program listings which have been written using information from the earlier chapters.

Although hardly models of style, a beginner could learn something from them: that there can be huge differences between the various versions of BASIC; that just because something is printed in a book does not mean it is correct; and the meaning of SN ERROR.

The book's lack of credibility is a surprise coming from Ken Tracton, author of the excellent *57 Practical Programs and Games in BASIC*, also published by TAB and Radio Shack.

To anyone who still feels like spending $5.95 for this book in spite of my criticism, I recommend that you consider one of the following alternatives:

1. Put the money back in your pocket and save it to spend on one of your other vices.

2. If you have no other vices, send the money to me. I do.■

Simutek
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by Jake Commander

Simutek supplies a high speed modification kit which can be installed by anyone with experience in electronics.

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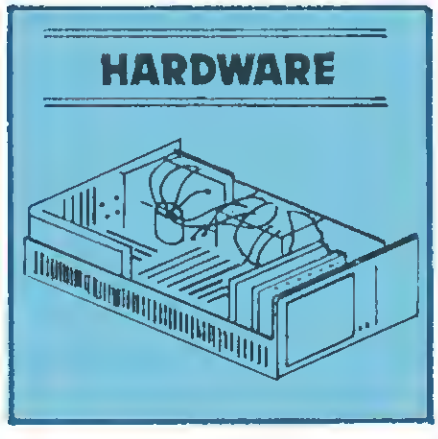
For example, your power-on LED flashes when in the high speed mode. This indicates an increase in CPU clock speed of 50 percent. The mod also disables itself during cassette and disk I/O, eliminating the need for software patches while using disks. It gives the normal baud rate when using cassette I/O.

The kit takes about an hour to install and comes complete with generous lengths of wire, and a push button switch to enable or disable the speed-up.

Documentation is adequate, although the printing is of dubious quality. This makes the photographic illustrations difficult to follow.

Nevertheless, for the price, you can't complain. You're covered by a 90-day warranty, and your computer will run 50 percent faster.

Incidentally, this review is written with Electric Pencil using the high speed mod, so you probably had trouble keeping up with the words. Proof that it works!■



Comprint 912
Computer Printers International
Mountain View, CA
$660

by Mike Aronson

When my printer was delivered, I was sure someone had made a mistake. I had ordered the Comprint 912 because of its small size and quiet operation; the shipping carton was huge. It was hard to believe the monster in this package would fit into my eight by ten study.

Opening the box was the first of several pleasant surprises. Inside the shipping carton was another box about half the volume of the outside carton protected by specially molded styrofoam corners. I marveled at the microcomputer industry's coming of age—here was a professional package! Inside was a second surprise: a sheet of unpacking instructions.

Comprint has taken care to assure that your printer arrives in good shape and that you don't destroy it with your first move.

For example, before you can load the paper, you must remove a yellow tag which warns you not to run the printer with the cover off. That is a great packaging method for people like me who are too impatient to read the sixty-four-page instruction manual.

Two Types

Printers fall into one of two types, matrix or impact printers. Impact printers work like a typewriter. A metal or hard plastic piece in the shape of a letter strikes an inked ribbon. Impact printers are usually noisier and have more mechanical parts than a matrix.

Matrix printers economize by using a single microprocessor controlled print head to produce every symbol. Each character is generated by a series of dots printed close together. The printer head is positioned close to the paper and moves across horizontally. Some matrix printers can use ordinary paper but others have no ribbons and must use special paper.

The Comprint 912 is an electrical matrix printer. It uses a special black paper covered with an extremely thin layer of aluminum that conducts electricity. The printer head is made up of twelve rigid wires in contact with the paper. If one wire is given a short electric pulse, the aluminum under the wire is vaporized, exposing the dot of black paper underneath.

With Comprint 912 a line of eighty characters can be printed in about one-third of a second. Adding the time it takes for a carriage return, a page of fifty-eight lines of solid print takes around 45 seconds.

One of the extra features of the Comprint 912 is the number of matrix dots used to form characters. Other printers use 5 × 7 or 7 × 9 (horizontal × vertical). The Comprint uses a 9 × 12 matrix to allow more defined letters, as well as lowercase letter descenders below the line.

To connect a Comprint 912 to your TRS-80, be certain you specify model 912-GP. An older, parallel version, 912-P, is complicated to connect. The model GP requires you to pull out one jumper plug and plug the printer cable into your expansion or printer cable interface. The only tool you need is a screwdriver.

There is an error on page 17 of the instruction manual dated March 1979. You will find the jumper plugs on the solder side of the printed circuit board, not the components side, so don't try to remove the printed circuit board. (The jumper plug is shown in its correct position in Photo 1.)

The printer comes with a one-hundred-foot roll of paper. Replacement rolls cost eight dollars for three hundred feet. You can write on the aluminized paper with either pencil or ball point pen, the bonding is very good, and no aluminum dust wears off onto your fingers.

My only disappointment with Comprint 912 has been that the up arrow prints as a square bracket. Evidently, Radio Shack uses a 91 code for up arrow and the printer expects a 94 code. Other than that, it works well and I have been impressed with its quality and usefulness.■

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[↑]↑
```

Sample Run from Comprint 912

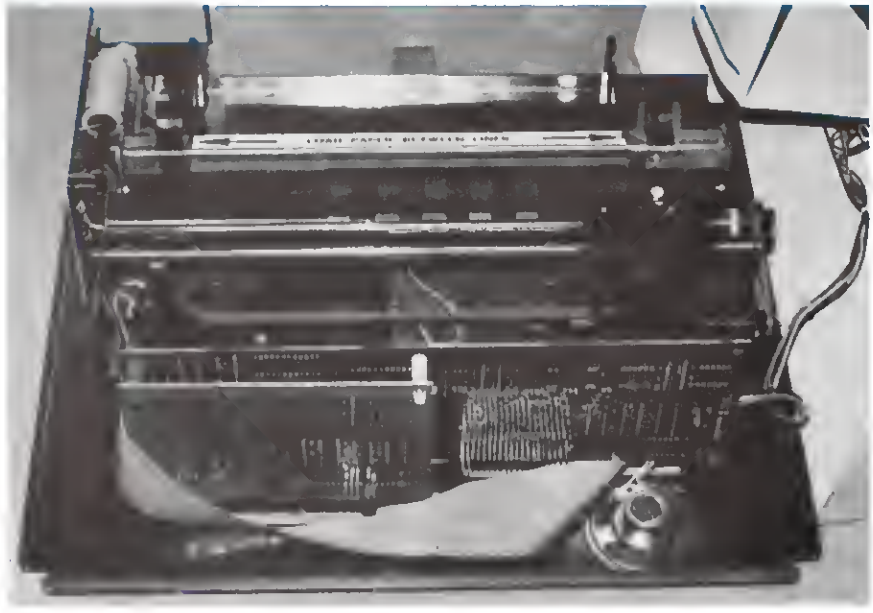


Photo 1. The jumper plug is the small rectangular piece just above the midpoint of the ribbon cable running across the front of the printer.

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✓-302

René Descates * Homer * Jeremy Bentham * Plato * John Adams * Pliny the Elder *
* Thomas Hobbes * Leibtniz * Ludwig Van Beethoven * Michelangelo * Sigmund Freud * Galileo Galilei *

kəm-'pyüt-ər\n

1: Device designed to execute a sequence of mathematical operations.

Education for the Home

Beginner's Russian

This package consists of three programs that graphically display the Cyrillic alphabet. The programs are arranged so that you progress from one to the next—building your knowledge as *you* progress. It includes instructions on proper pronunciation of the letters and even an introduction to simple Russian words.
Order No. 0136R $9.95

Everyday Russian

Everyday Russian will acquaint you with the Russian words relating to: foods, places to eat, everyday signs, and the names of common stores. You will also learn the order of the Cyrillic alphabet. Each of the three divisions of this package will teach you the words and then quiz you on comprehension. You can even practice typing in Russian, using your TRS-80 keyboard as a "Cyrillic typewriter."
Order No. 0137R $9.95

The Russian Disk

Now you can have *both* the Beginner's Russian and Everyday Russian packages on floppy disk! Requires an Expansion Interface with 16K and one disk drive.
Order No. 0212RD $24.95

Teacher

This program allows you to input any number of questions and answers. The computer will prepare tests, give quizes, provide up to three hints per question and even give (optional) graphic rewards for correct answers. Perfect for parents, teachers, or anyone faced with learning a lot of data in a short time.
Order No. 0065R $9.95

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Four programs for budding lexicographers, etymologists, or anyone else who uses words. In WORD RACE, you must choose the proper definitions. Find the misspelled word in HIDE N SPELL. Take a pre-recorded quiz in SPELLING BEE, in which the words are played aloud! Meet variations on proper spelling in SPELLING TUTOR.
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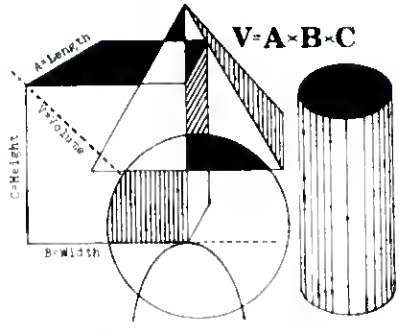

Archimedes' Apprentice

A tutorial software package that will teach you the formulas used to find the volume of *any* solid object. It covers parallelopipeds (cubes and rectangular solids), prisms, pyramids, cylinders, cones and spheres. It can even quiz you on how well you learned the lesson.
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A complete seven-part package that guides you from familiarization with the keyboard, through typing words (and phrases), to mastery of touch typing. Your video monitor becomes a bottomless page for typing practice!
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All packages listed are for the TRS-80 Model I Level II; they require 16K of memory and are cassette-based unless otherwise indicated.

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ej-ə-'kā-shən\n

1: The action or process of training and developing knowledge.

Education for the School

Basic Math Program from EMSI

The Basic Math Program is a comprehensive math teaching package. It was created by a certified math teacher with 15 years of programming experience.

The first three programs comprise: Whole Number Arithmetic by Teaching Objective. This set includes Addition, Subtraction and Multiplication. The fourth program is Fractions and Mixed Number Arithmetic. Logic and Deductive Reasoning is the fifth program in the set. The Metric/English Conversion program rounds out the series.

You choose from a MENU of options, so as to custom-tailor both practice and test sessions. The program options include: Number of Problems/Session, Level of Problem Difficulty, Number of Seconds/Problem, Type of Assistance to be Offered, and Type of Reward.

The package includes a 60 page teacher's manual that contains detailed instructions on how to use the programs. It shows you *exactly* what material will be on the monitor and how to select the program options. It further explains how to analyze the session results by number of problems correct, actual problems given, if an incorrect digit was entered, if it was corrected and whether the HELP feature was used.

Fractions and Mixed Number Arithmetic shows the student every step of how to solve the problems. It waits for the student to enter each answer and, if he makes an error, reviews the material so the error can be found.

Deductive Reasoning is a modified and much improved Mastermind-type exercise.

Metric/English Conversion will convert quantities (length, area, volume and weight) from Metric to English, or English to Metric.

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The Teacher's Aide package is perfect for parents, teachers, and students who need the unlimited patience and undivided attention only a computer can provide. Readin', writin', and 'rithmatic will never be the same—now that you have the Teacher's Aide package from Instant Software.

This package requires the following minimum system:

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Word-IV
Disk Based Word Processor, $49
IDM IV Data Base Manager, $69
Micro Architect, Inc.
Arlington, MA

By Don DeJarnette

For the past several months, Micro Architect has advertised a word processor and data base manager at very reasonable prices. I was somewhat skeptical of the low prices, but the advertised features convinced me to purchase both systems.

Word-IV—Disk Based Word Processor

Word-IV is a disk-based BASIC language word processor. Text and format control data are entered exactly as one would write a disk BASIC program.

Features of the system are: page length, page width, beginning point of page, automatic page numbering, page centering, left and right justification, line spacing, title generation for each page, special character generation and space reservation on succeeding pages.

Word-IV fully supports the upper and lower-case capabilities of your printer. To produce an uppercase letter, the up arrow is typed preceding the letter. This may seem a bit awkward at first, but once you get used to the procedure, it is easier than typing a shift uppercase letter.

The text and format program is stored as a separate file on the disk, using the ASCII extension. The length of the text is limited only by memory and disk storage capacity. Editing is very easy, using the EDIT command in DOS BASIC. After producing the formatted text and saving it on disk, you are ready to load the Word-IV program into DOS BASIC. This is followed by entering the saved ASCII file. A unique feature of this program is the ability to run more than one of the same program or a combination of different programs.

The text and formatting are executed in BASIC. This opens up many possibilities for modification.

There are several problems with the program. BASIC is exceedingly slow, an important consideration if production of lengthy reports is your primary concern. This article runs in about 6-7 minutes. For some reason, you cannot load a text program saved in ASCII back into DOS BASIC for further editing. This means that if you anticipate further editing, the text program must also be saved in BASIC. There is also a problem with the program generating a ?. Each time the question mark appears, you must type .sc 63. (.sc stands for special character. This program handles "?" as a special character.) These problems are minor in my opinion and certainly correctable. ■

IDM-IV Data Base Manager

IDM-IV is a disk-based, BASIC language data base manager. It consists of three separate programs: initialization, data base manager and report.

Initialization requires that the user input file specification data, such as naming the string and numeric fields (up to ten numeric and ten string), determining the number and size of the fields, choosing the key field, specifying the number of records and naming the file. This information is then formatted on the diskette.

String fields contain up to 255 bytes, while numeric fields are limited to four characters. The total record is limited to 255 bytes. Record totals are limited only by your disk storage and memory capacity. I routinely sort a data base of 500 items with very few problems.

The Data Base Manager program is next loaded into disk BASIC. Through use of the ADD facility, you begin entering information in response to questions asked by the computer. These questions are created from the initialization program data that you have supplied.

Once data entry has been completed, the report writer segment of the Data Base Manager is entered. Up to ten different reports built to your specifications are possible. Options included in the report writer include a selection of any number of fields to be printed, total or average of all numeric fields, multiplication and division of any of the numeric fields. In addition a numeric filter lets you specify values within a set range, e.g., only list purchases between $50–$100 or only list customers between 20–40 years of age (up to four numeric filters are possible per report). String sort keys allow the IDM user to sort up to four string fields. After the criteria for the report have been selected, it is saved to disk.

Report is the last program to be entered into the computer. Two options are possible: data base listing, which prints the entire data base and is formatted to duplicate a file card, and format report, which lets you select one of the reports that you created with the report writer.

IDM-IV has two problems in common with WORD-IV: too much disk I/O and the characteristic slow speed of BASIC. In spite of these two problems, this is a fantastic data base manager. ■

Radio Shack
Disk Instruction Course
Tandy Corporation
Ft. Worth, TX
$29.95

by Robert L. Zappa

Recently, I upgraded my system by adding disk drives. While anticipating their arrival, I read the TRSDOS manual, but file structures completely confused me.

The Radio Shack computer catalog describes their Disk Instruction Course as a step-by-step guide in the use of DOS and Disk BASIC. I bought it and for $30, plus tax, I got four Radio Shack disks, each with one lesson containing six to eleven parts.

My Expectations

This is one of the poorest examples of computer-aided instruction I've ever seen. Everything of merit would fit into a small twenty-page pamphlet including the covers, and still leave room for an appendix of all the politicians who have lusted after the presidency. I expected a course which, using DOS with some sample programs and files, would systematically lead me through the complexity of files and the specific DOS and Disk BASIC commands. That is to say, I expected the course to be interactive with the disks. Radio Shack does not say that's how the course is designed, but it seems a logical expectation.

The format of the course is a series of short comments, followed by a few questions. If the questions are answered correctly, you proceed. The content is to the point, but at too simple a level. Neither by description nor through practical experience does it expand upon anything described in the original manual.

The course does clarify the manual. Its very triviality demystified disk operations. No longer awed by the obscurities of the DOS Manual, I took a program from *Kilobaud Microcomputing* and translated it into Radio Shack dialect. Through translation came understanding and, eventually, I hope mastery.

If you want to learn how to use your disk drives, buy yourself a box of disks—ten disks are about the same price as the course—take the DOS Manual and your computer magazines and work through a short meaningful program. ■

MMS FORTH
Miller Microcomputing Services
Natick MA
16K Diskette $64.95
16K Cassette $44.95
MicroFORTH Primer $15.00

by Terry Kapner

Terry, you should try FORTH. It's really simple to use.

Mike was once more extolling the virtues of his latest discovery. He was dying to get me hooked on it. Thus far, I had managed to escape this latest language for the TRS-80, but I couldn't help being drawn to the keyboard every time I heard him chortle or gloat over another feature of his new toy.

Finally I decided to take the fatal plunge. At the first opportunity I equired my own copy of FORTH. I chose MMS FORTH from Miller Microcomputing Services; theirs was available on disk, as well as tape. (Mike had the tape version from Programme International, Inc.)

The Manuals

The Programma version includes everything in one manual, written by the Programma people, while MMS uses two manuals. One is the *micro-FORTH Primer*, available from FORTH, Inc. (the people who invented it), and a second manuel written by MMS.

The MMS manual contains all the additions and alterations made by MMS to the standard version of FORTH, plus instructions on how to use the MMS FORTH version effectively. A nice feature of the MMS version is the use of TRS-80 BASIC words for FORTH commands.

For example, CLS in FORTH means the same as it does in BASIC, clear screen. Likewise INKEY$ and so on.

The *micro-FORTH Primer* is a very informative manual that contains a glossary of all the terms used in FORTH, and also includes a clear and concise explanation of how to write programs. The manuel is invaluable while learning the language, and I strongly suggest that any one interested in FORTH programming purchase it.

FORTH is a hybrid language, combining the clarity of a high level language like BASIC with the speed of low level language programming in assembly.

Unlike BASIC and most other high level langueges that separate the programmer from machine code, FORTH allows the programmer to maneuver easily back and forth between high level easy to use programming techniques and direct assembly language programming. Thus you can interchange programs between different processors using FORTH, with only minor alterations to specific routines.

FORTH uses a technique known as Indirect Threaded Coding. Each instruction in FORTH is composed of pointers that lead to other pointers which ultimately lead to executable machine code. This means that FORTH is a stack oriented programming language. It is composed of a number of assembly language modules, or primitives, each with a specific task or purpose. These primitives are each named and can be selectively called up or combined into words. This technique is what gives FORTH its tremendous power.

Unlike other programming languages, the ability to define new words, or primitives, in the FORTH dictionary is always available to you through its Catalog function. And there is no run-time penalty for these new words.

For example, CLS is a FORTH word made up of two primitives—home cursor and clear to end of page. So whenever you want to clear the screen, you enter the word CLS.

Another example is LIST. LIST is used to put a page of memory on the video. Now suppose you want to clear the screen each time before you put the new page on the video, you can enter CLS and then 10 LIST (to list page ten of memory). Or you can define a new word that uses these two words in its own definition, calling it CLIST, like this:

```
: CLIST CLS LIST ;
```

From then on, every time you entered 10 CLIST, you get a clear screen and then the new page ten listed. And CLS and LIST are still available for use separately.

If you want to save added new words for future use, it can easily be done using the command DWTSECS (include the proper parameters, of course).

Suppose that your present version of FORTH doesn't have the proper primitives or predefined words to do the task you have in mind. In that case, if you have the machine code know-how, you can define your own primitives directly in FORTH, using the built-in FORTH Editor Assembler, and add them to its catalog.

If your catalog becomes too large for convenience, just instruct FORTH, via the keyboard, to FORGET the extraneous WORDS.

In order to make this as easy as possible, FORTH uses the same syntax in all operations: keyboard, assembler, editor, everything.

There are three stacks used in FORTH. The most commonly used stack is the parameter stack, which starts at the high end of memory and works its way down. This particular stack's function is for user inputs and outputs, and is also used as a scratch pad by the various words and primitives. The second stack is the return stack, which also starts at high memory and grows towards low memory. It is used primarily by FORTH as a loop counter. The last stack is a hardware stack used by the Z-80 processor and is not normally available to you in programs.

One of the reasons for the efficiency of FORTH lies in its stacks. Because of these stacks, permanent memory locations do not have to be assigned to temporary variables. This cuts down tremendously the amount of overhead memory required to run FORTH.

One very nice mathematical feature of FORTH is its ability to switch from one number base to another, without any run-time penalties. All the FORTHs support the standard bases of HEX, OCTAL, and DECIMAL.

In Summary

FORTH is a very versatile language, combining the best sides of both high level and low level languages, excluding many of their disadvantages.

- It is easily extensible and just as easily contractable.
- It allows interfacing of equipment to software with comparatively minor work done by the user.
- Most programs can be switched from one processor to another with only minor changes.
- Programming is structured, with control passing from the most general of commands downwards to the most specific. Many programs may be executed just by entering their name.

In view of these facts many programmers will find FORTH to be just what they need to develop software for new hardware devices compatible with the TRS-80. After all, FORTH was orginally designed to help astronomers use computers to control radio telescopes and other experimental devices with a minimum of time spent in programming.

There is one last note. Unlike the other Z-80 versions of FORTH, MMS supports only the 8080 Assembler commands. Some people will look upon this as a disadvantage. However, after reading both manuals, it is easy to see that it would not require too much work to write a new assembler for the Z-80 commands (in FORTH of course). However, for the not-so-ambitious, MMS is now selling an add-on utility that supplies the Z-80 Assembler Editor and full floating point math routines. ■

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(*TRS - 80 is a Radio Shack Trademark)

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80 NEWS

edited by Nancy Robertson

Is accessible software a temptation to steal?

Software Libraries: A Controversy

A library, according to *Webster's New Collegiate Dictionary*, is "a collection of literary, musical, artistic or reference materials; it is also a collection resembling or suggesting a library (such as a library) of computer programs." Software libraries, however, are fairly new on the scene.

According to Jeff DeTray, Associate Publisher of Wayne Green, Inc., there are two kinds of software libraries. The first involves a group of software users getting together and contributing programs of their own devise into a common pool of programs. The group composes a list of available programs and within the group one can borrow—essentially it is a software exchange.

The second kind of software library is a commercial venture started by a private individual or individuals. The operator of the library buys, for example, two or three of every kind of program available on the market, and often includes books on microcomputers in the collection.

After the library is stocked with materials, an ad is placed in one of the computer publications advertising lending services. The lendee pays an annual membership fee and a smaller fee for each program lent. The borrower is then allowed to keep the program for a designated period of time, say one or two weeks.

Existing Software Libraries

How many of these libraries are there? How long have they been around?

Much of this information seems to be shrouded in mystery. I dug up three different operations: one which was located in Standish, Maine, had a post office box number and no phone; another which was located in Rockville, Maryland, had a phone that was only in operation one night a week for three hours; and another I contacted.

Raymond Gabriel of Ohio is presently in the process of establishing a "home computer library division" as a part of his present company. Gabriel says that the development of this library was inspired by the purchase of a TRS-80. After becoming familiar with it he "became fascinated by the prospects, especially for home use in the future."

Presently, Gabriel's library has 25 members, over 100 software programs and about 30 books. Annual membership in the library is $20. New members have 30 days to try the service. If they aren't satisfied, the full membership fee is returned. Rental charge is based on 20 to 25 percent of purchase price.

Gabriel stresses that "software libraries are no different than any other kind of library." Yet, there are some people in the industry who would vehemently disagree with him. There is much opposition to the development of software libraries because of the problem of programs being duplicated, resulting in profit losses for both companies and authors. And thus far the issue of copyright laws protecting software has been a hazy one.

Your local library might lend programs some day.

The Copy Problem

Why are software programs more susceptible to being duped than books, for example? DeTray says, "The difference between books and programs is that books are tedious to copy and usually the photocopying costs will run a bit of money, however to make a copy of a program is very simple and it doesn't cost much. In fact the temptation is huge, I can't imagine someone borrowing a program and not copying it."

Gabriel does admit that copying is a problem but feels that the benefits of such a service outweigh this negative aspect. Gabriel says that if the legality of software libraries is going to be in question then the general library system should be in question. As a specific example, Gabriel raised the question of home video and whether it too, would be considered in violation of copyright laws.

Gabriel feels that software libraries can help the business. He says, "We are providing a market for authors who might not normally sell many of their programs. For example, if we carry it and someone borrows it and likes it, chances are he'll go out and buy the program when he might not have before." Gabriel also says, "By providing this service we are creating a greater interest and thus are helping to create a market for programs."

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Library Controversy

Continued from page 47

Arguing Against Software Libraries

Herv Pennington, e software developar, feels that software libreries cheet euthore. For example, he seys, "You loan a guy a disk that costs $100 and he makes a copy. . . the guy that spent all that time developing it, the author, doesn't make a cent and the guy that is running the library makes five or six dollars per program, depending on his fee."

Not only are they doing euthors e disservice, but they ara elso hurting growth of the industry, in Pennington's opinion. "The euthor who is losing money after spending hours developing programs is going to esy 'the hell with it, I can make more money selling resl estate.' " Besically, Pennington, like meny others, feels thet the libreries "steal an author of his right to en income."

Ed Juge of Tandy has similar feelings, "If the people who are involved in these libraries ever spent a couple of months developing software and then tried to sell it to the public, they would have e different perspective. It's simply not a viable thing." Juge feels it's a matter of copyright, but es he pointed out, "no one at this time knowa what copyright is. Perhaps copyright will teke care of this situation. In effect the whole scheme is a ripoff, library developers are knowingly or unknowingly keeping en euthor from the benefits of his labors."

Publisher, Weyne Green seys, "The library concept in the microfield is a destructive one." Green feels strongly about software developers being cheated. "Instant Software is prepared to invest a good deal in suits to protect its authors."

Discouraging Copying

Is there any way the industry can discourage copying?

PT Wolfe, manager of Instent Software, says that Instant Software prices its software inexpensively enough to discourage copying. For exemple, Wolfe says that for $7.95 it's worthwhile to purchase the whole peckege rather then ecquire only e copy of the program et a comperable price. Juge says thet his company, Tandy, uses the seme epproach, by pricing their software reasonably so that "the average person would be more likely to buy the whole package."

Pennington has a different idea. "Booke never lose in court," he says, "ano thet's what we will do, write books with the programs which can be typed in and debugged—end in the back of the book there will be, for exemple, e coupon to go to your local dealer end buy the disk if that is preferred." When copying becomes less of a problem, the ettitude toward software libraries may change.

Advantages of Software Libraries

There are some software authors who do see the edvantages presented by software libraries. Author Dennis Kitsz believes eccess to information is essential. Kitsz says, "In fact, if it weren't for program treding, the industry wouldn't have grown as fast as it has. More computers heve been sold merely because of the eveilebility of software programs."

Kitsz believas that while tha industry is still in its experimental stages, and there are only a handful of magazines doing reviews, it's unreasonable to expect a user to wait for the product to be reviewed. In most cases he'll just go to the club and see for himself.

Kitsz thinks that libraries in general are a good thing and that they also are essential. "Software programs are not yet evailable (at the public library), because there is not enough consistency of format. But what happens when they are? You can't encourage computer literacy without having the software available."

Another author and a treder of original softwere says, "I epprove of libraries, but I disepprove of the pirating, and seriously—how can you stop it? It (software) is no longer a multi-thousand doller item. There are some good programs end there is some real garbage; it's understandable thet an individual would like to know in advance what he is buying."

Moral Questions

The issue of whether software libraries should or shouldn't exist reises a number of questions. By trying to stop these software libraries, is there an injustice being done by preventing access of information? Do these libraries encourege growth in the industry by promoting evailability, or are they hurting the industry by making it eesy to steal? Exactly how much protection can the new copyright law offer?

Chief of Circulation at the Boston Public Library, Mr. O'Halloren reports that of the 800,000 books end materials (records end cassettes) that the general library circulates in a year, 1½ percent of the materials are never returned, roughly 12,000 books, records end cassettes annually. O'Halloren summed up by saying, "There is no library that is getting back 100 percent of what they are giving out."■

By Pamela Petrakos
80 Staff

Software Copyright Law

Late in 1974, Congress enacted a bill esteblishing the National Commission on New Technological Uses of Copyrighted Works (CONTU). The commission conducted a three year study into the need for including software in the current copyright laws.

Six long years later, H.R. 6933, incorporating the recommendations sat forth by CONTU in their finel report, was finally introduced in March of this year. The bill wes passed into law August 20th.

Until this time, software copyright has been in end out of controversy and under numerous limitations and restrictions. It hes been protected by the vagaries of judicial interpretation and the whims of individual state lawmakers, whan it was protected at all.

House bill 6933 was introduced by Rep. Kastenmeier of Wisconsin, and the Committee on the Judiciary recommended that it be pesaed into law. Primarily addressing the patent and trademark laws, it also amends Title 17 of the U.S. Code (USC) dealing with copyrights. The sections of 17 USC directly effected by the bill ere 101 and 117.

Section 101 has been amended to include a definition of computer programs, as "e set of statements or instructions to be used directly or indirectly in e computer in order to bring ebout e certain result."

Section 117, dealing with limitations in exclusive rights, has been amended to allow the purchaser of e copy of e program to make another copy or edeptation of that program only if:

- The new copy or adaptation is mede as "en essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner," or

Continues to page 55

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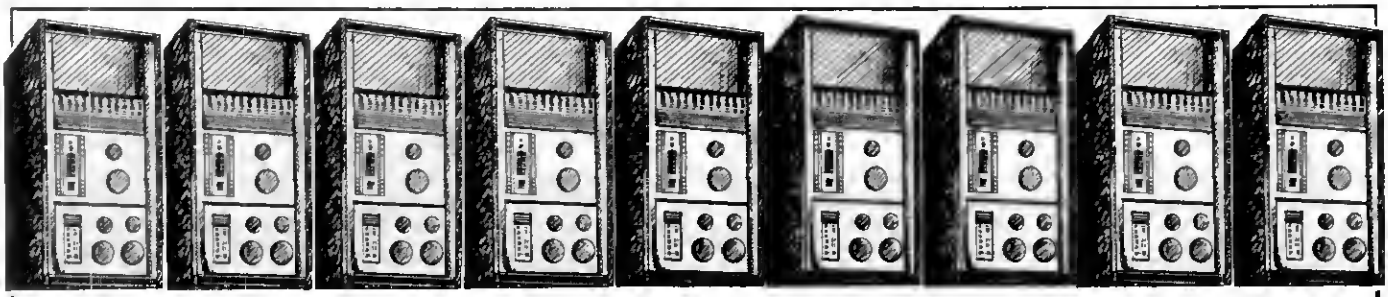

Standards Become Important for Networks

Standardization. Efforts at it are all around us. The newscasters, chattering on the tube obediently speak a midwestern normal dialect of American English. No "ayups" or "y'alls" will be heard from their well-groomed ranks.

And now, the computer industry is struggling to develop its own set of standards with regard to information transfer and access, in an effort to facilitate the interconnection of machines of different manufacture.

The thorny problem of system standardization has been around for some time. Its solution has lately become critical because of the increasing role being played by machines in 20th century life. And whether or not you are in favor of machines consorting with each other, the fact remains that the power of machines is greatly enhanced once they can be connected.

An example: Bureaucracies (especially in government) are great fans of computers since they feel responsible for a considerable amount of data. Unfortunately, variations in equipment and software make it almost impossible for the Federal Government's machines to talk with the state governments', for states' machines to communicate with the citys' and for city governments' to interface with either.

Ethernet and National Standards

Recently, government and industry groups have been working on the problems of standardization in an effort to hammer out some acceptable design norms. Working primarily through the IEEE (Institute of Electrical and Electronic Engineers), an industry group composed of Xerox, Digital Equipment Corp., and Intel has developed Ethernet. Ethernet is a system for local network interconnection. It specifies design criteria as well as other aspects of network operation.

On the federal side, the National Bureau of Standards Committee on Computer Science and Technology has been working on projects like FIPS. FIPS, or Federal Information Processing Standards, has basically the same goal as the IEEE's Ethernet—establishing standards for computer use that will facilitate the interconnection of devices. Devices as diverse as microprocessors and mainframes are involved in the Federal Government's standardization program.

Harry White, Chief of the Standards Administration Office of the Institute of Computer Science and Technology within the National Bureau of Standards, feels that eventually all systems, small and large, will have interconnect capability. His group has been working with the IEEE and others on the standards necessary to make this possible.

Standards Effect Networking

In Mr. White's opinion, the standardization efforts are "going well," and industry cooperation is assured. "If vendors want to do business with the government, they must conform to our established standards for hardware and software. In essence, our clout is economic since the government represents such a large segment of these people's marketplace." With industry cooperation expected, the road to universal standards may be a smooth one.

When queried about the impact of his standardization efforts on small system users like TRS-80 owners, White indicated that the time when 80 owners will have the ability to interconnect with mainframes is not far off. "For the near term, the S-100 bus structure will be central to our microcomputer standardization efforts."

White also indicated that the CP/M operating system appears to be the most practical for the vast majority of applications and is compatible with operating systems of much larger machines. CP/M and an S-100 bus structure are options that are currently available to 80 owners.

One word of warning White provided related to the configuration of S-100 structures. "Users must be firm when it comes to dealing with vendors," he said. "They must be sure that the S-100 bus they end up with is the standard version. Right now there are several versions in use and some confusion exists as to what a definitive S-100 structure really is."

Gerald Clancy, chairman of the IEEE's Local Area Network Standards Committee, indicated that his group is not really concerned with the small system user yet. Instead, the focus of the IEEE's efforts has been on establishing standards relating to local networks interconnected by coaxial highways. Several large office buildings within the same city, each containing many terminal and mainframes, is an example of this type of network.

Clancy's group has developed a three part program covering Protocalls, interfaces and modems/transceivers and feels that they have completed 95 percent of their work on establishing standards. He is confident that all remaining obstacles will have been overcome and the committee's work completed before the first of the year. For the time being, it appears as if the IEEE activities will have little affect on the day to day computing reality of 80 owners.

X-21 not RS-232

In Clancy's view, "Networks consisting of machines located in the home will not be a reality until cable TV services become widespread." Until that time, Clancy feels that most small system users will remain isolated from mainframe interconnections. When they are connected, "X-21, not RS-232 is likely to become the standard structure in modem interfacing for small machines," he predicts.

The importance of on going standardization efforts does not lie in their immediacy, however. What today's standardization efforts bode for the future is of importance. The era of instant interconnect is not yet a reality but the simple fact that government and industry professionals perceive a need for standardization indicates that the role of the machine in our lives will, inexorably, expand. ■

Scanned by Ira Goldklang - www.trs-80.com

Spinning Facts about Disks

So you have finally come to a point in your computing affair when you're bored with cassettes. You've known all along that cassettes are slow, serial and unreliable, and now you've gone beyond their limitations with your own abilities. So what do you do?

You read. Information can be hard to come by though, and if you're wondering what exactly disks are, how they work, and if they are really worth all that money, you may find some answers here.

Disks come in various sizes and are available in both hard and soft varieties. The soft type are called floppies and are constructed of mylar which has been coated with a magnetic oxide. Soft disks used on Radio Shack and other small computers are either eight or 5 1/4 inches in diameter. The 5 1/4 inch disks are called mini floppies and cost about $2 each.

One mini floppy disk is capable of storing 83K bytes of data. Floppy disks are enclosed in a protective, paper dust jacket and spin within their jackets when operating. The inside of the jacket is coated with a dry lubricant and disk cleaning agent that keeps the disk surface clean and smooth.

Disk Access

Access to the disk is gained through four openings (illustrated in Fig. 1) in the disk jacket. The largest, in the center of the disk, accepts the friction drive mechanism when the disk drive door is closed. The oval opening provides the read/write head in the disk drive with access to the disk surface.

The notch in the upper edge of the dust jacket is the write protect notch. When this notch is not obstructed, information may be placed on the disk. When it is obstructed, no write operations may be performed on the disk. The disk is said to be "write protected" if this is the case, and this safety mechanism is intended to ensure that no data will be inadvertently written over.

The smallest opening on the disk jacket is the sector index hole. A photoelectric sensor in the drive mechanism senses the location of this hole and orients the disk controller to sector zero. The beginning of all the tracks of the disk coincide with the location of this hole. The TRS-80 system employs soft sectored disks. That means that the beginning of only one sector is physically marked by a hole. All other sector bounderies are marked magnetically.

When new, disks are blank on both sides and before they can be used they must be formatted. Formatting a disk divides the disk surface in an orderly fashion and a formatting routine to do this is usually included as a utility in the DOS (disk operation system) software.

Disk Sectors and Tracks

A Radio Shack TRSDOS formatted disk is divided into 10 pie shaped wedges, called sectors. In addition, 35 concentric circles called tracks are overlaid on the disks sectors (See Fig. 2). Data is magnetically placed along the tracks and throughout the sectors. Track numbering starts at 0 on the outer edge of the disk and proceeds inward. Each of the disk tracks can thus occupy several sectors.

A sector is capable of storing 256 bytes and since track length decreases toward the inside of the disk, packing is more dense on inner tracks than on outer tracks. A disk directory file (list of disk contents) normally occupies track 17 and information encoded here tells the disk controller chip in the drive unit where to find specific files on the disk.

The disk drive mechanism provides the logic and locomotion for the read/write head in its travels across the disk surface. The disk controller chip calls the shots and the drive motor must spin the disk up to 300 RPM before any read/write operations can take place. A highly accurate stepping motor in the drive unit steps the head from track to track across the surface of the spinning disk.

Wear and Tear

If you think this life style is rather strenuous for the flimsy floppy, you're right. Disks are tough customers though, and have a rated life of five years of actual use, or 2,500,000 passes per track (approximately 110 hours). As disks age, it is common to encounter problems with the densely packed inner tracks. Frequent read/write errors on inner tracks are indicative of a worn disk.

Disks are also susceptible to other forms of trauma. Dirty environments foul them up. By dirty I don't necessarily mean the bondo room at the local body shop. A smoke filled office or seedy basement laboratory can be enough to give disks fits. Disks prefer being comfortable too: While they will operate over a wide range of temperatures, disk I/O (input/output) errors become more frequent as temperature variations increase. In spite of all their frailties, disks are remarkably rugged and take abuse as well as the next peripheral.

The Price Tag

Now, what about cost? Disk system prices vary widely, but a figure of about $450 per drive is average. Since two drives are better than one (and in most cases necessary), we are looking at a $900 investment in an $800 computer. Add to this the price of an expansion interface (if you don't already have one), plus the cost of operating system software and we are talking big bucks.

Is it worth it? Well, I guess that depends on two things: how much money you've got deflating in the neighborhood Savings and Loan, and what type of applications you expect your system to serve. ■

By Chris Brown
80 Staff

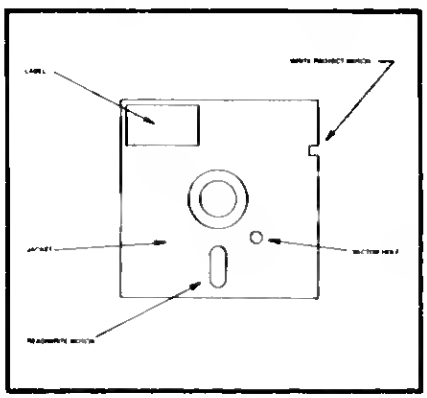

Fig. 1

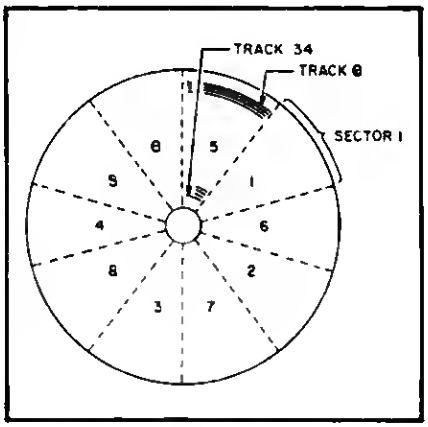

Fig. 2

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Software Syndicate Scheme

IJG, Inc., Upland, CA, is putting a novel marketing plan into effect: For the first time, major and minor software manufacturers will join in a syndicate with a nationwide circuit of software stores. The plan, targeted for January 1, 1981, is the first to solidify a national distributorship for competing lines of software. IJG's Harv Pennington is coordinating the schema.

According to one source at IJG and another representative in the software industry, IJG is reputed to have signed Michael Shrayer Software, Palm Springs, CA, makers of The Electric Pencil; Scott Adams of Adventure International, Longwood, FL; Meta Technologies, Euclid, OH; Apparat, Denver, CO; Racet Computers, Orange, CA; and Remsoft, also of Euclid. Other contracts are being negotiated.

According to sources, IJG's plan will put a custom mix of software from any number of manufacturers into a software outlet for as little as 10 percent of its retail value. A minimum order of $1,000 will represent $10,000 of software at the suggested retail price.

A conservative estimate involves only 100 outlets, each investing a minimum of $1,000. If they are able to turn merchandise three times in the first year, it will mean a potential $3 million in sales for retailers. How much of this or any other figure is profit to the dealer or to IJG remains unknown.

When queried, Jeff DeTray, assistant publisher at Wayne Green, Inc., expressed some doubt as to whether a software store could turn $10,000 in stock in a year, let alone four months. Others in the industry share his view.

Cornerstone is Capital

The key to this software conglomeration is capital. The cornerstone to the IJG plan is its ability to pay manufacturers up front for their software at a standard distributor discount.

For its part, IJG guarantees the software to the dealer. A marketing package which maintains each manufacturers identity, but carries the IJG distribution logo in the bottom corner is being designed.

IJG will further guarantee its software mix to the retailer; in the event that it is unsalable, a dealer may return it to IJG.

The marketing plan further sets the stage for national ad campaigns from manufacturers in support of dealer sales. It provides for a coming of age in software advertising that includes co-op advertising in which a national manufacturer will share the cost of local advertising.

The Computer Services Division of IJG has for several months been promoting software packages available at a number of "Authorized IJG Dealers." Such advertising has appeared in *80 Microcomputing* where, in October, IJG's two-page spread included a page devoted to Westech Corporation's Small Business Inventory System and the listed 12 dealer outlets, including mail order houses, where the program is available.

The plan remains tentative. Several unanswered questions include dealer discounts, control of such a syndicate of manufacturers and the nearly hostile competitiveness among some manufacturers.■

By Michael Comendul
80 Staff

Say Hello to 80

If there is a major microcomputer show in your area, be sure to stop by the *80* booth to say hello and to enter our free drawing. We're collecting names, and on July 4, 1981, we'll select one of them to win a Level II TRS-80.

At every show, we award $100 worth of Instant Software programs to a visitor. The winner from last August's Personal Computing '80 Show was Jon Wolfe of Clayton, NJ. ■

Appeals Court Rules on Data Cash *vs* JS&A

In Chicago, IL, the U.S. Court of Appeals for the Seventh Circuit upheld the decision of a lower court in the suit Data Cash had filed against JS&A Group, Inc. While the September decision of the Appeals Court agrees that JS&A had not violated a Data Cash copyright, it overturned the reasoning behind the ruling.

Data Cash programmed ROM for a computer chess game which they marketed. They filed the suit in 1979, arguing that JS&A used the same ROM to market a computer chess game at a lower price.

In the earlier decision of the U.S. District Court, Judge Joel M. Flaum indicated that copyright did not apply because the ROM was a machine part. However, the recent decision by the three judges on the Court of Appeals clearly extends copyright protection to ROM programming.

Under the laws in effect at the time of JS&A's actions, the appeals court ruled, Data Cash should have carried a notice on the ROM to warn others that it was copyrighted.

The case will go back to the district court for a judgement on the portion of the suit dealing with unfair competition.■

Help Wanted

Programmers and technicians are needed for *80 Microcomputing* and for Instant Software. Write to *80 Microcomputing*, Peterborough, NH 03458.■

Software Copyright Law

Continued from page 48

● It is used only for archival purposes and destroyed if continued possession of the copy or adaptation becomes illegal or inequitable.

As amended, Section 117 goes on to state that exact copies of programs can be leased, sold or otherwise transferred "only as part of the lease, sale, or other transfer of all rights in the program." Adaptations can be transferred only with the copyright owner's authorization.

This is a large change in the law. This section previously put limitations on the author of the software, rather than the owner of a copy of it. As the old law stood, owners of copyright had no rights, except those a court might grant in an action brought under Title 17.

Since the copyright laws did not include, or even clearly exclude, software as a protected work of authorship, authors had to look to very general laws (often state laws) for protection. Their other choice was to face a fight over the legal interpretation of "work of authorship."

Title 17, as amended, now clearly and fully protects computer programs under all of its sections. This will not destroy any protection an author may have under individual state laws.■

By Debra Mershell
80 Staff

NEW PRODUCTS

Programmable Video Game

The Maco Micro Module (M3), is a programmable video game.

Hand controls connect to two eight-bit input ports to provide 72 combinations of forward, back, left, right, pull up, push down, twist right and twist left. An audio generator with a hardware toggle may be used to produce end-of-cassette loads, audio prompts, music and game sounds. An accurate real time clock or timer with continuous display may be implemented with the 1/10 second interrupt generator without tying up the processor.

Comput-A-Sketch, Micro Organ, Brickyard, and Real Time Clock are included on tape.

The interface, two hand controls, expansion cable, instruction manual and cassette sell for $129.95 from Maco Manufacturing, 1383 Airways Blvd., Memphis, TN 38114.

Reader Service ✓336

Tax Help for 80 Owners

Tax/Saver, an interective income tax program will be introduced in mid-January 1981 by Micromatic.

This new tax package helps the taxpayer prepare the return in the logical order used by professionals and according to the latest tax rules.

If there is more than one way of doing the return, Tax/Saver allows the user to compare and choose the best result. Tax/Saver compares itemized deductions to national averages, automatically computes certain limitations (on medical deductions and contributions) handles community property, checks for excess FICA and helps determine deductions for dependents. It completes long and short tax forms and is tax deductible.

Tax/Saver is written for TRS-80 16K, Level II. Cassettes cost $65. Four diskettes for 32K TRS-80s with two disk drives cost $80, from Micrometic Programming Co., P.O. Box 158, Georgetown, CT 06829.

Reader Service ✓332

Updated IBM Typewriter Interface

The 50/80 Interface for connecting a TRS-80 to an IBM Electronic typewriter Model 50, 60 or 75 has been improved, according to Mediamix. It now gets feedback from the typewriter. The driver program that supports this interface uses the feedback to control timing. Benefits include faster typing speed and more control over the typewriter's automatic functions. The 50/80 Interface is available for the TRS-80 Models I, II, and III.

Mediamix has introduced another version called the 50/80 Interface Plus that uses an EPROM. This eliminates the need to load a software driver program and saves RAM space. The EPROM includes Mediamix's INMOD 3 program which provides upper/lowercase driver, blinking cursor, repeat keys, typewriter-style keyboard and user-definable input length. The 50/80 Interface Plus works with the TRS-80 Model I only.

The MX80 Firmware Interface for the Model I, also from Mediamix, is similar to the EPROM decoder in the 50/80 Interface Plus. The MX80 uses the reserved 2K of lower memory in the TRS-80 keyboard.

No prices were released. For more information contact Mediamix, P.O. Box 8775, Universal City, CA 91608.

Reader Service ✓330

Swim Meets with TRS-80

Three Sports programs from Misc. Inc. deal with setting up and scoring swim meets. While timing computers have been used in the past, these programs permit the use of the TRS-80 in timing swim meets.

Misc. Inc. claims that SM3.1 can reduce the time of seeding and printing the heat sheet for a large swim meet by 40 to 70 percent.

Most of the programs require a Level II 16K and a line printer; some programs require 32K and disk. The swim meet programs range from $50 for cassette to $100 for an interactive disk program from Misc. Inc., 1530 Butternut Circle, Gastonia, NC 28052.

Reader Service ✓338

The Micromatic 80

8000 Not 800 Baud

In September *80* published an announcement of Personal Micro Computers, Inc.'s high speed cassette loader Fastload. It was incorrectly printed that Fastload loads tapes at 800 baud. The loader actually operates at 8,000 baud. Our apologies for the misprint.

If you just bought another printer, boy are you gonna be sorry.

Epson.

The Epson MX-80. It's not just another worked-over rehash of last year's model. It's our top-of-the-line 80-column printer. It's new. From the ground up. And it's the most revolutionary printer to hit the market since Epson invented small printers for the 1964 Olympics in Tokyo. Don't take our word for it, though. Compare. There simply isn't a better value in an 80-column printer. Period.

But here's the fact that's going to stand the printer world on its ear. The MX-80 sports the world's first *disposable* print head. After it's printed about 50 million characters, you can throw it away. Because a new one costs less than $30, and the only tool you need to change it is attached to the end of your arm.

Now that's revolutionary, but that's only the beginning. The MX-80 also prints bidirectionally at 80 CPS with a logical seeking function to minimize print head travel time and maximize throughput. It prints 96 ASCII, 64 graphic and eight international characters in a tack-sharp 9x9 matrix. And it provides a user-defined choice of 40, 80, 66 or 132 columns and multiple type fonts.

We spent three long years developing the MX-80 as the first of a revolutionary series of Epson MX Printers. We employed the most advanced automatic assembly and machining techniques in existence to produce a printer that is incredibly versatile, remarkably reliable and extraordinarily inexpensive. It's a printer that could only come from the world's largest manufacturer of print mechanisms: Epson.

If it sounds like we're proud of the MX-80, we are. Not only does it do things some of the world's most expensive printers can't do, it'll do them for you for less than $650. That's right. Under $650.

And if that isn't revolutionary, we don't know what is.

The world's first disposable print head. It has a life expectancy of over 50 million characters, yet it's so simple, you can change it with one hand. And it costs less than – repeat less than – $30.

✓404

EPSON

EPSON AMERICA, INC.

23844 Hawthorne Boulevard, Torrance, California 90505. Telephone (213) 378-2220

Mediamix 50/80 interface.

IBM Selectric Printer

The Micromatic 80 from the Micromatic Corp. is a printer and interface designed for the TRS-80 and other small computers. The printer is a reconditioned IBM Selectric combined with a TTL-based interface.

The printer, according to Micromatic, has a speed of eight to nine characters per second and connects to the keyboard interface port or to the TRS-80's expansion interface.

Micromatic 80 contains all code conversions and timing software and is warranted for 90 days. The Micromatic 80 costs $795 and is available from the Micromatic Corp., 5147 West 85th St., Indianapolis, IN 46278.

Reader Service ✓325

TRS-80 Interface Accessory

E&L Instruments' IF-100 TRS-80 interface accessory provides buffered I/O connections for control, monitoring and testing of external devices and development and testing of I/O devices.

The IF-100 plugs directly into the TRS-80 bus, enabling any TRS-80 incorporating Level II software to be used for practical applications.

The IF-100 contains a built-in power supply to avoid loading down the TRS-80, supplies on-board logic probe, device and memory decoding, bus buffer, control signal buffering and solderless breadboarding facilities for quick interface and control circuitry assembly.

The IF-100 is priced at $180 in kit form or $245 fully assembled and tested. The TRS-80 interconnect cable is priced at $25. The cable is extra. For information, contact E&L Instruments, Inc., 61 First St., Derby, CT 06418.

Reader Service ✓335

Programs Manage Radio Stations

The Electric Log and the Electric Bill from The Management perform computer traffic and billing for radio stations on the TRS-80 Model I.

The Electric Log stores up to 500 spot orders and automatically generates daily program logs. Orders may be displayed, changed, deleted or updated at any time.

The Electric Bill stores up to 500 accounts and provides direct access to current status of all accounts. It automatically updates each customer account after entry.

Prices for the programs were not released. For further information, contact The Management, Box 111, Aledo, TX 76008.

Reader Service ✓340

Basic Link Facility

The Utility Package for the TRS-80 Model II from Racet Computes provides the user with eight new DOS commands.

XHIT, XGAT, XCOPY and SZAP recover data from bad diskettes. XCOPY provides multiple-file copies, I/O and directory error recovery modes and absolute sector mode. SZAP can be used to examine or change a sector on a diskette. DCS consolidates directories from multiple diskettes into a single display or listing. DISKID changes the name of a diskette. XCREATE creates a file. The Utility Package costs $150.

Also from Racet is a BASIC Link Facility (BLINK) for the Model I or II. It allows the user to run one BASIC program, and then transfer with one command to another BASIC program without losing variables in memory. The Model I version for 32K (one drive) costs $25, and the Model II version costs $50.

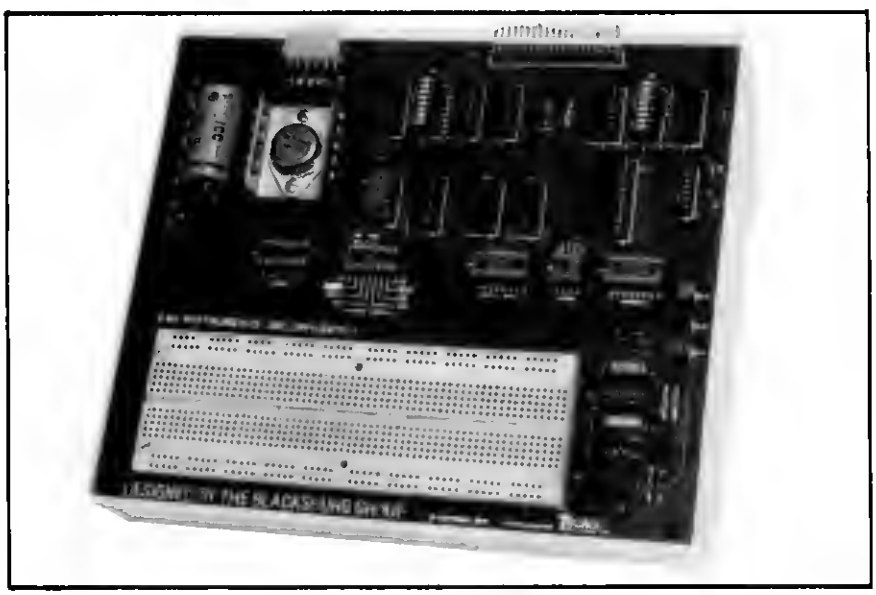
Both are included in the new software catalog from Racet Computes, 702 Palmdale, Orange, CA 92665.

Reader Service ✓345

Earth Science Programs

The Earth Science Series from TYC Software contains 12 independent educational programs covering a junior or senior high school earth science curriculum. Topics covered are: latitude and longitude, gradient, heat energy lost and gained, basic chemistry, steam erosion, water budget, seismic waves, earth history, seasons, meteorology, and percent error.

An accompanying lab aid program includes 20 of the most common formulas



E&L's IF-100 Interface Accessory

Scanned by Ira Goldklang - www.trs-80.com

LESS THAN SUGART • PERTEC • MPI

GIANT MICROPOLIS SALE

For TRS-80 only
By popular demand sale is extended until Nov. 31, 1980

MICROPOLIS 35 TRACK 5¼" DRIVE	$358.66
MICROPOLIS DUAL 35 TRACK 5¼" DRIVE	$716.43
MICROPOLIS 77 TRACK 5¼" DRIVE	$442.71
MICROPOLIS DUAL 77 TRACK 5¼" DRIVE	$808.56
NEWDOS/80 and 10 FREE DISKETTES	$149.00

Alpha Byte Storage
4636 Park Granada
Suite 159
Calabasas, California 91302
(213) 883-8594

• Free shipping included • All drives are brand new from the factory • Mail or phone orders accepted • We Wire Master Charge or Visa • Dealer orders accepted • Offer good as supply lasts • See our other ad in this months publication for more great deals • Send for our free giant 80 page catalog

LESS THAN SUGART • PERTEC • MPI

GIANT MICROPOLIS SALE

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4636 Park Granada
Suite 159
Calabasas, California 91302
(213) 883-8594

• Free shipping included • All drives are brand new from the factory • Mail or phone orders accepted • We Wire Master Charge or Visa • Dealer orders accepted • Offer good as supply lasts • See our other ad in this months publication for more great deals • Send for our free giant 80 page catalog.

NEVER UNDER SOLD

Find the best price you can in this magazine on a box of 10, Verbatim 5¼ inch Floppies and subtract $.50; THAT'S OUR PRICE— We include the shipping (please figure the competitor's shipping and handling charges in your computation).* Compare our prices on other equipment; if we're not the least expensive, give us a call. If you don't see it, give us a call. WE HAVE LOTS OF STUFF!!

THIS MONTHS SPECIALS

SPECIAL #1
If you purchase the "TRS-80 DISK AND OTHER MYSTERIES" Book for the regular price at $22.50
you can buy 10 VERBATIM DISKETTES AND a plastic library case for $22.00
TOTAL $44.50

SPECIAL #2
If you purchase APPARAT NEWDOS+ for the regular price of $99.95
you can buy 10 VERBATIM DISKETTES AND a plastic library case for 5.00
TOTAL $104.95

SPECIAL #3
If you purchase APPARAT NEWDOS/80 for the regular price of $149.00
we will give you a box of VERBATIM DISKETTES AND a plastic library case ..... FREE
TOTAL $149.00

SPECIAL #4
If you purchase the MICROSOFT BASIC COMPILER for the REDUCED PRICE of $190.00
we will give you a box of VERBATIM DISKETTES AND a plastic library case ..... FREE
TOTAL 190.00

PRICE LIST

Blank Diskettes	
Verbatim 5¼"	$26.50
Verbatim 8"	30.00
Verbatim 8" Double Density	44.00
Aids	
Percom Seperator	27.00
Flippy Kit	11.95
16K Ram Kit (200ns)	49.00
Hard Hole Tool	4.00
refills (50)	9.95
Plastic Storage Box 8"	3.00
Plastic Storage Box 5¼"	2.50
Plastic Diskette Sheets (10)	6.95
Software	
We have lots!!	CALL
Hardware	
SOROC IQ120	775.00
CENTRONIX 737	CALL
ANADEX DP-8000	855.00
PAPER TIGER w graphics	939.00
LOTS MORE PRINTERS IN STOCK	CALL
LEEDEX VIDEO 100 12"	124.95
SHUGART SA 400 (35 track same as Tandy)	349.00
MPI B-51 (40 track)	359.00
PERTEC (40 track)	359.00
Supplies	
9½" x 11" Paper	20.50†
11" x 14" Paper	32.85†
Labels, Print Wheels, Ribbons	CALL

SEND FOR FREE CATALOG
†Add shipping for paper only.
*OFFER good as supply lasts.

Free shipping for orders over $20.00.

Alpha Byte Storage ✓69
4636 Park Granada
Calabasas, California
91302 (213) 883-8594

All drives are brand new and include chassis and power supply.

used in experiments. The program helps the student with his calculations, and it also reinforces his knowledge of the formulas he has used. The student can create graphs of his results with an additional routine. None of these programs require previous programming knowledge, according to TYC Software.

Designed by educators to meet specific classroom needs, the programs are illustrated with graphics. The Earth Science Series comes with a teacher/student manual which contains student objectives, worksheets, answer keys and user instructions. The 12 programs are on four cassettes in a vinyl storage binder. The programs require a 16K TRS-80 and cost $61.45. For more information contact TYC Software, 40 Stuyvesant Manor, Geneseo, NY 14454.

Reader Service ✓327

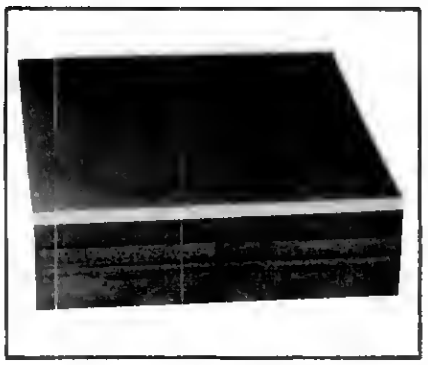
Eight-inch Disk Drive

The MS-800 line from Matchless is a line of eight-inch disk drives, compatible with the TRS-80 Models I and II.

The drives have a capacity of 256,256 bytes, with a data transfer rate of 256,000 bits per second. These products also have a track-to-track access time of 10 milliseconds, according to Matchless. The use of four drives provides a storage capacity of two Megabytes on the TRS-80 Model II.

The MS-800 line for the TRS-80 Model I or II costs from $995 to $1795. $995 is the base price for a single drive and documentation. The $1795 price tag is for two drives, all the hardware that any system would require to adapt to the drives and an operating system. The eight-inch MS-800 line of disk drives is sold by Matchless Systems, 18444 S. Broadway, Gardena, CA 90248.

Reader Service ✓343



MSL/II-800 Eight-inch drives for Model II

Disk BASIC Compiler

ACCEL2 is a Disk BASIC compiler. It produces machine code translation of selected Disk BASIC statements and functions in all four types of variables.

ACCEL2 has six diagnostic messages and a set of local/global compilation options to increase compatibility with subject programs and to control output code growth.

The ACCEL2 compile-time routines are self-relocating and occupy 5120 bytes, while the run-time component takes only 1024 bytes.

The compiler is supplied on cassette and sells for $88.95. ACCEL2 was recently developed in Britain by Southern Software and is now being marketed in the U.S. by Allen Gelder Software, Box 11721 Main Post Office, San Francisco, CA 94101.

Reader Service ✓342

Monitor Performs "Interpretive Execution"

Ultra-Mon is a machine language monitor for the TRS-80 from Interpro. It has a disassembler, and performs "interpretive execution." It fetches, decodes and projects the result of each operation before execution, according to Interpro.

The monitor's interpretive execution allows for a hard copy trace disassembly and for setting of breakpoints in RAM or ROM. The monitor is ROM independent and relocatable, and costs $24.95 from Interpro, Box 4211, Dept. CCM, Manchester, NH 03105.

Reader Service ✓331

Stock Analysis and Mass Mail Programs

A new stock market system from Galactic Software is designed for the active trader. It tracks selected issues, and reflects them against the overall market.

The program is a guide to indications, and is not to be used as a sole recommendation to buy, sell or hold an issue, according to Galactic.

The user inputs setup data from Standard and Poor's stock guide or Value Line. Daily issue data such as highs, lows, close and volume are input from a newspaper. The user also inputs daily overall market volume and "closing Dow" from a newspaper. The system analyzes a given issue by comparing volume and price changes of the overall market. The system will also compare an issue against itself, allowing the user to spot unusual activity.

The Stock Market Monitor System is designed for the TRS-80 Model I and Model III. It is available for 16K machines on cassette and 32K machines on disk. The cassette version costs $89 and the disk costs $99.

The Mass/Mail System, also from Galactic Software, allows 3500 entries per expansion drive up to a total of 10,500 on a four-drive system.

The system supports two standard label formats and two standard directory formats. The user may design an additional output format.

All inputs are taken through a full word processing editor with transparent cursor, type-over, insert and delete. Data files are sorted by first name, last name and zip code. Retrieval is by alphabetical or zip code order, plus any of six other circuits. Access by a key field is always less than ten seconds, according to Galactic.

The Mass/Mail System is designed for the TRS-80 Model II. It requires 64K and from two or four disk drives. Files created by the system are compatible with Galactic's Model II Mail/File System. Prices were not released.

Both Mass/Mail and Stock Market Monitor Systems are available from Galactic Software Ltd., 11520 N. Port Washington Rd., Mequon, WI 53092.

Reader Service ✓333

Energy Efficient Programs for Construction

Two new construction industry programs by Disco-Tech calculate not only a building's energy efficiency, but according to Morton Technologies, also calculates cost effectiveness.

Though designed to comply with California's Title 24 energy legislation controlling building design, heating/cooling equipment and lighting, both NRG-1 (residential) and NRG-2 (commercial) programs are applicable outside of California, as well.

According to Disco-Tech, NRG-1 printouts may be submitted directly to local building departments.

TRS-80 Model I hardware required is 48K with two mini-disk drives and a line printer. Cost of NRG-1 is $650. The price of NRG-2 is $450. The package price for both programs is $1,000. The programs are available from Disco-Tech, Morton Technologies, Inc., P.O. Box 11129, Santa Rosa, CA 95406.

Reader Service ✓328

COMPUTER PROGRAM ASSOCIATES

Presents .....

✓209

HDOS-2™ Hard Disk Operating System for Model II With CORVUS Drives Works With TRSDOS* and Microsoft BASIC, Does Not Replace It!!

No need to abandon your TRSDOS software when you get a CORVUS hard disk drive. With HDOS-2 you can use your existing programs with only minor modifications. There are no changes to TRSDOS 1.2/2.0 or BASIC! HDOS-2 resides in only 1K of high memory, and is accessed by USR calls from BASIC. Simply replace your GET and PUT statements with HDOS-2 commands, and you're ready to go. HDOS-2 is supported by a complete set of operating system commands, including a hard disk SUPERZAP. This is the system you need to make the most of your Model II with a hard disk drive. HDOS-2 can open up new frontiers for your business software!

TRSDOS Commands: HBASIC, HCOPY, HCREATE, HDIR, HFREE, HINIT, HKILL, HRENAME, HZAP
BASIC Commands: (Defined Functions): Open, Gat, Put, Lof, PEEK, POKE, SCR, DUMP, CURSOR

Price: $125 for all utilities (source code extra).

Financial Accounting Packages: Our accounting packages were designed by a C.P.A. with years of experience in accounting systems. All packages are self-booting and menu driven, and are designed for use by persons with little or no computer background. Each package is designed for a 2-disk system, and comes with our internal documentation (file layouts, variable descriptions, etc.), allowing easy modification for form alignment, customizing, etc. Unlike Radio Shack programs, these have a consistent structure and are designed with customizing flexibility in mind. Error trapping routines reduce operator errors, and review of each transaction is allowed before acceptance by the system. Reports print on 8½" x 11" paper for easy handling. Manuals are included in the price.

Accounts Receivable with Billing
Model I : $250
Model II: $350

Invoices, Credit Memos, Statements, Aged Accounts Receivable, Daily/Monthly Sales Report (Detail & Summary by Category), Sales by Salesman, Maintenance Report, etc. Allows Balance Forward and/or Open Item methods, with full customer inquiry at all programs. Each invoice can have up to 35 different line items, with automatic extension of quantities, totaling, computation of sales tax and freight, etc. Invoice and statement forms are available for use with system. Up to 1200 customers, no limit on transactions.

General Ledger
Model I : $175
Model II: $275

Grouped Balance Sheet and Income Statement, General Ledger Audit Trail, Trial Balance, Operating Income Statement with Percentages, Payroll Tax Report (for 941's, W-2's), etc. This system is easy for the non-accountant to use, with an automatic credit to cash during check entry, and validation of general ledger account numbers. Account numbers up to 5 digits (including alphanumeric) are allowed, with no requirements as to sequence or ranges. Up to 400 accounts, 1200 transactions per month.

Accounts Payable with Checkwriting
Model I : $250
Model II: $350

Checks with remittance advice, Accounts Payable Detail by Vendor, Aged Accounts Payable Summary showing Cash Requirements, Vendor Maintenance Report, etc. This system does everything! Check runs may be for all or selected vendors and pay dates for individual invoices may be changed at any time. Invoices may also be paid by batch. Interactive with General Ledger, with automatic entries to cash and accounts payable. Allows up to 16 general ledger accounts per invoice, with discount computation and default payment terms by vendor. Up to 500 vendors.

Also available — General Ledger with Job Costing, Accounts Receivable with Cycle Billing and others.

To Order: Call or write Computer Program Associates at the phone/address below. Shipments normally made same day. C.O.D. orders add $10.

*TRSDOS is a registered trademark of Radio Shack, a division of Tandy Corp.
All software sold "as is" and "with faults".

Satisfied Customers from Coast to Coast.

15056 Beltway Drive • Dallas, Texas 75234 • (214) 233-2039

An overview of microcomputer interconnects.

Electronic Networks

"There were buttons and switches everywhere—buttons to call for food, for music, for clothing. . . . There was the button that produced literature. And there were of course the buttons by which she communicated with her friends."

from "The Machine Stops"
by E. M. Forster

by Nancy Robertson
80 Staff

Those lines from E. M. Forster's short story were written before the invention of the computer and before the surging growth of communications networks. Through electronic networks of terminals, microcomputers and central computer banks, we are entering an age when science fiction can become reality.

Electronic networks and communications aren't as new as they seem. From your social studies class in elementary school, you should remember that in 1838 F. B. Morse demonstrated his invention—the telegraph—and electronic communications were born. A few decades later Alexander Graham Bell invented the telephone.

Today four out of five homes in the United States have telephones. And most of us have experienced the mix of excitement and anxiety that are brought on by the delivery of a telegram. With the computer connection, electronic communications have entered a third dimension.

Quoting figures from a recent International Data Corp. study, Walter Anderson of the U.S. General Accounting Office points out that "There are already 2.6 million general purpose, intelligent terminals (including micros) involved in computer networks in this country."

Transfer of Data

How do the networks operate, what do they offer, and how can TRS-80 owners participate?

To use the industry jargon, these networks are used for data communications and electronic mail. These terms overlap a great deal in meaning and usage. Data communications, often called datacomm, refers to the electronic transfer of data. Data, of course, is "factual information used as a basis for reasoning, discussion or calculation." Electronic mail refers to messages generated, transmitted, and/or delivered electronically. A message is any communication "in writing, speech, or by signals." Essentially both datacomm and electronic mail are electronic communications.

A few legal eagles, however, insist that electronic mail refers to the electronic communications that pass through the hands of the U.S. Postal Service (USPS) and other public utilities. In this sense of the term, the prime example is the Mailgram service offered jointly by Western Union Electronic Mail, Inc. (WUEM), a subsidiary of Western Union, and USPS.

To send a Mailgram, customers telephone WUEM with an addressed message; WUEM transmits it electronically over wires, cable and/or satellite to a post office; the electronic code is printed and hand delivered by the mailmen. Mass mailings such as credit card and magazine subscription billings are often sent as Mailgrams.

Earlier this year Tandy made a business agreement with WUEM allowing TRS-80 users to connect via modem to Mailgram service. Tandy has created software that will generate Mailgrams at 300 baud. Included in the package is a credit application to be filed with WUEM. Once a line of credit has been established, mail lists and letter texts can be input by an 80 into WUEM's central memory bank in McLean, VA. Mass mailings can then be initiated from the TRS-80 keyboard.

Mailgrams may give way to the USPS's E—COM. August 15, 1980 the USPS Board of Governors voted to begin E—COM (Electronic—Computer Originated Mail) service by January 4, 1982.

The original E—COM proposal, which was presented two years ago, suggested using the existing Mailgram equipment to expand the system under complete control of the Post Office. The recent decision will open the supply of electronic transfer equipment, central storage computers and wire carriers to the best bidders. If companies other than WUEM supply the system, the TRS-80 hook-up will probably have to be modified and renegotiated. But 1982 is a long way off in terms of computing and software advancements; many other developments may take place in the meantime.

Public or Private

Right now there is a battle brewing between public and private communications networks. In May, the Federal Communications Commission (FCC) released its decision on the Second Computer Inquiry. In the past the FCC has regulated communications suppliers, such as AT&T. In May, the commission decided to deregulate private suppliers of "enhanced" electronic communications systems. The decision applies to companies such as CompuServe, which offers customers a variety of communication services through their network's central computer bank.

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The PMC-80 will operate with any of the many peripherals Radio Shack and other independent vendors have invented to plug into the TRS-80.* Most importantly, the Interface Adapter permits Expansion Interfaces with memory expansion to 48K to be added. An Expansion Interface will also permit the addition of Radio Shack compatible 5¼" disks and disk operating systems, RS 232, printers, etc.

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Above: The inner sanctum...CompuServe, Columbus. Left: DEC hardware and tape backups at CompuServe.

USPS may not be pleased with the FCC decision, which will allow private competition with their E—COM service. GTE Telenet Communications Corp. and Tymnet, Inc., which are common carrier suppliers of wire, telephone lines and satellites for most communications networks, are entering the mass mail market this year.

If the competition becomes too heated, some fear USPS will tie up the deregulated suppliers of electronic mail and the FCC in a judicial battle. Under the Post Office's Private Express Statutes, USPS has sole right to carry letters; and letters are broadly defined as "messages directed to specific persons or addressees and recorded in or on a tangible object."

In the meantime, business and industry are using private computer communications networks in a variety of ways. Perhaps the most common use is interoffice communications. For instance, major airlines use networks for flight reservations. Labor unions are using networks to share wage scale information as pay varies from region to region or company to company. The Green Thumb Project, a network sponsored by the U.S. Department of Agriculture, the University of Kentucky and the Weather Service, is designed to help farmers plan plantings and crop sales.

Through time-sharing networks such as CompuServe Information Service, Columbus, OH and The Source, McLean, VA, micro owners can get into the action. They can send messages to friends and associates, even electronic editions of daily newspapers, access programming languages, play adventures, get the latest stock reports, copy recipes from *Better Homes and Gardens* and record biofeadback.

Although the computer networks that exist today differ in size, application and complexity, they all are variations on the same theme. Terminals, or micros functioning in the same role, are connected by common carriers to central computer banks. Messages or data travel from the terminal across wire or satellite to the central processing unit of a computer bank. The central computer examines the information, responds to the original terminal, or forwards the information to another computer or terminal.

Suppose for a minute that you have just subscribed to CompuServe Information Service. While you're looking over the latest stock reports, you recall a friend on the West Coast. He too subscribes to CompuServe. You've been meaning to give him a call. You want to tell him that a mutual friend has resurfaced in your area.

Being a clever guy, you decide to send your friend a cryptic line: "Recalled to Life: Smart Hands." How does the message get to San Francisco from New Hampshire?

The message and its address are printed on the CRT. With a modem connected to your micro and the access software loaded, you dial the local CompuServe number. The video page is arranged in a packet of bytes, translated to electronic frequencies, and sets off across the telephone lines at the rate of 300 baud.

At the local exchange, the packet is switched to another line, wire or satellite and travels on to the central computer bank in Columbus. The first few bytes read by the central computer indicate that it is a message to be posted to another subscriber.

"Recalled to Life: Smart Hands" is stored in the West Coast publication's electronic mailbox (file space in the network's main memory that is reserved for a particular subscriber) in Columbus. A confirmation is returned to New Hampshire that the message has been posted.

Sometime later, your friend hooks up to CompuServe from his office in the bay area. The first words that appear on his video display tell him he has mail.

"Recalled to Life: Smart Hands" then takes off on another trip across country. Riding the wires to Frisco, the packet switches to a local line, reaches the modem, is translated from electronic frequencies to binary digits and appears on your friend's CRT. Let him cogitate over this awhile.

Software Connection

Radio Shack is offering retail subscription sales to CompuServe Information Service. It has developed Videotex software which allows micros to function as terminals, and is also retailing the TRS-80 Video-

tex Information Terminal.

The Videotex Information Terminal will be shipped for the first time this month. It is Radio Shack's first dumb terminal, designed specifically to access CompuServe.

A terminal is simply an input/output device for a network. It can be used to input data and receive and display data or other information from a central, host computer. Dumb terminals can perform only these basics, which are called on-line functions.

Kenneth Bosomworth, president of the International Resource Development Co. and editor of the *Electronic Mail & Message Systems* newsletter, Washington, D.C., explains that "As you type your name on the keyboard of a dumb terminal, it will appear on the screen. But all alphanumeric inter-

The Columbus

Jeffrey Wilkins of CompuServe, Inc.

In their broad-winged metal helmets and thick-clothed jerseys with chrome badges, the fire crew waits uncomfortably in the lobby. They have come to run a routine monthly check for electrical fire hazards. A closed-circuit TV scans the room, displaying the back of the receptionist who sits in a booth similar to a judge's bench; the firemen shuffling about in their heavy boots on the thick carpeting; the head of security speaking into his walkie-talkie; and a woman carrying a briefcase and camera. This is the foyer of CompuServe, Inc., Columbus, OH.

I am waiting for security clearance, an identification card and publicity director Rich Baker to guide me through the central offices and main computer bank. Baker comes down the wide stairs and introduces himself. The receptionist gives me a nametag that attaches to my lapel.

So Much Security

Even Baker needs permission to enter that part of the building housing the computer bank. For the second time, I question the reason for so much security. Few of the 350 company employees are permitted to enter the computer centers without approved escorts.

Inside, most of the long room is filled with row after row of Digital PDP-10s and PDP-20s—roughly half of the company's 21 mainframes. For backup, every piece of data stored in the PDPs is also stored on reel to reel tape. The blue reels stocked on shelves cover nearly a third of the room. This room and another like it are the heart of CompuServe's computer network.

From the computer bank, I am taken to meet CompuServe, Inc.'s president, Jeff Wilkins. He is surprisingly young to head a company that had revenues of $20 million in 1979. He has been president of CompuServe for nearly all of its 11-year history.

Wilkins explains the company's birth and development succinctly. CompuServe was originally established as a subsidiary of Golden United Investment Co., to provide the parent company with data processing and to sell the same services elsewhere. In June, 1975, CompuServe spun-off from Golden United and became an independent publically held company. A half of a share sold for $1 at that time. Within a year the stock split and CompuServe had 12,000 shares outstanding—the same total number of shares Golden United had at that time.

In 1979, CompuServe's stockholders agreed to sell the company to H&R Block, Inc., the tax preparation company. The purchase was made May 12, 1980. Wilkins believes Block bought CompuServe "to put themselves in a marketplace that is growing faster than the tax markets."

Wilkin's history with CompuServe began in 1970. That year he left Arizona, where he had received his graduate degree in electrical engineering, and where he and friends had established a solid business designing and building home alarm systems.

"My father-in-law was involved in the holding company that started CompuServe. He wanted me to come out right away and start the data processing company. The difference between electrical engineering and computing didn't occur to him. I told him that I didn't know anything about computing, but I had a friend who did."

Third Employee

That friend was the first employee of CompuServe. Wilkins was its third. "I liked what I was doing in Arizona," Wilkins said. "I enjoyed having my own company, so I really didn't want to come out, although by this time both my friend and my father-in-law were really urging me to come."

Finally Wilkins was offered $1.5 million in equity to get CompuServe started. He decided to take a closer look at the prospects. "I set down the ground rules—I'd have complete control." He accepted the position and moved to Columbus.

Wilkins has maintained the same degree of control since the merger with H&R Block. "I'm still the Chief Executive Officer and am responsible for making decisions about strategy and growth. The main difference is that instead of reporting to the board of directors at CompuServe, I report to H&R Block's executive vice president and am a member of their board."

"One of the things I've always enjoyed about this business is how quickly it

pretation is done by the host which returns the information to the CRT or printer."

But some terminals have more intelligence.

When a terminal is not linked to a central computer, it is off-line. If a terminal can perform off-line functions, it is an intelligent terminal. The number of off-line functions can vary from basic editing to the general purpose applications of a microcomputer.

The generic term "videotex" refers to uniform screen formatting for purposes of data transmission. Tandy's Videotex products format screens of 32 characters across by 16 lines deep. These dimensions should reproduce on any CRT without dropping any charecters.

Walter Parkerson, who wrote the soft-

Connection

changes. You have to have the ability to anticipate, to be two or three years ahead of the market." From data processing, CompuServe expanded into a service offering a combination of hardware and software to business and industry.

CompuServe's bread and butter has come from over 650 customers in business and industry. Time and time again, their publicity refers to their many Fortune 500 clients. In businesses as diverse as mining, investment banking and fiberglass, their customers include AMAX, Greenwich, CT; Goldman Sachs, New York, NY; and Owens Corning Fiberglass, Toledo, OH. Government agencies, such as the Department of Transportation, are also clients.

AMAX, a company which is between 35 and 40 on Fortune's list of giants, has annual sales of approximately $4 billion and profitability, of about a half billion, according to their director of research, John Thornton. CompuServe has maintained the company's hardware and software, and provided an international communications system since 1973. The communications system hooks up 350 computers around the world, including about 15 which are located underground in mines. Thornton believes, "CompuServe is one of the best—if not the best—time-sharing companies in the country."

Referring to CompuServe's industrial and business background, Wilkins states, "As we watched the industry develop, it became apparent that these new applications would lend themselves to a consumer market."

Under CompuServe, Inc.'s umbrella, the CompuServe Information Service (formerly called MicroNet) offers consumers—micro and terminal owners—information and communications facilities through the company's time-sharing network. The rate for the service is five dollars per connect hour.

Under the heading of news, Associated Press (AP) wire service, electronic editions of several newspapers; recipes and meal planning from *Better Homes and Gerdens*, and the Tandy/Radio Shack newsletters are available.

Communications services include the ability to post and store messages electronically, and a network bulletin board which serves the same function as classified advertising.

A category of services designed specifically for computer hobbyists offers games, software catalogs, programming languages, etc. (The hobbyists' time sharing service is now called MicroNet—just to maked things confusing.)

Presently, Radio Shack is the only retail outlet for CompuServe Information Service subscriptions. Radio Shack's outlets are selling the subscriptions along with the software to allow all micros to access the network. Starting kits assign user identification numbers and passwords.

In another effort to reach the consumer market, CompuServe Information Service will also be offered via cable TV. A pilot of a two-way cable service is being conducted by Warner/Amex, CompuServe Inc., and Atari, Inc. Warner/Amex, Columbus, OH, owns Qube, the interactive, two-way cable TV station which will carry the service.

High Level Technical Skills

CompuServe Information Service is a logical extension of the company's products, yet Wilkins points out that it requires a different mix of skills than setting up industrial research or communication systems.

"CompuServe has been successful because of the high level of technical skills. Even in the beginning, our technical skills were high, but marketing was low. We have been able to move into the personal computing market so easily because of our technical people.

"Part of my job here is to keep a good mix between the wizards and the suede shoe boys, or between the machine-oriented people and the people-oriented people.

"Nobody knows the size of the personal computing market yet; nobody knows what's going on out there. But I don't think there's room for very many players right now—although there may well be, if the market continues to grow.

"There are two things every consumer wants to know about anything he can buy: What does he get from it? And how much does it cost? The changes that will come to microcomputing because of computer networks will be evolutionary in nature. They will be brought on by the market, not by technology. There is still not a mass consumer market."

With names like Goldman Sachs, the Department of Transportation and AMAX on the satisfied customers list, consumer and hobbyist markets are just the tip of CompuServe's iceberg. It's these business and industry giants that account for the routine fire checks, the plush carpeting and the maximum security measures.

by Nancy Robertson
80 Staff

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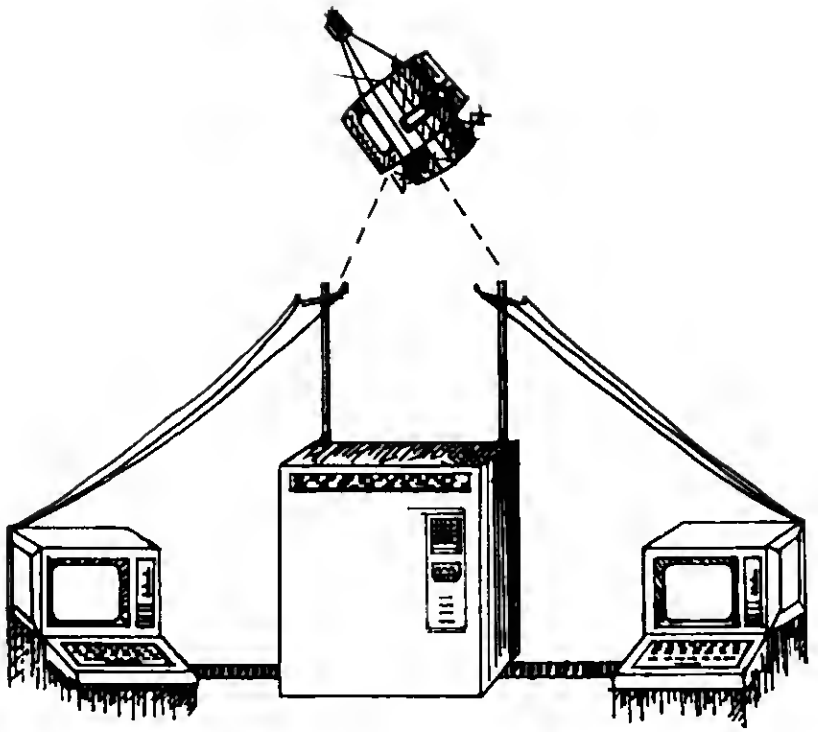


ware for Radio Shack's Videotex terminal, says it could be called "a limited intelligence terminal." For video display the terminal plugs into any television set via the antenna outlet. It can be attached to a printer as well. The terminal has a built-in modem and comes with either 4K or 16K memory.

Before it goes on line, the memory can be filled with whatever you wish to save or transmit. After communicating with the computer bank, it will save all of what has been received—unless the buffer capacity is exceeded. On the 4K model, that is eight video pages. On the 16K, it is 32. Each video page consists of 512 bytes and forms a packet when it is transmitted.

Tandy's interest in terminals relates to the computing industry's crystal ball. The Yankee Group, Cambridge, MA runs a profitable business prophesying what will come next in electronic communications. They are one of several voices predicting that home users will be interested in network communications, but not necessarily in computing. Editor Bosomworth points out that "The general purpose nature of microcomputers requires more training than terminals designed for specific communications needs."

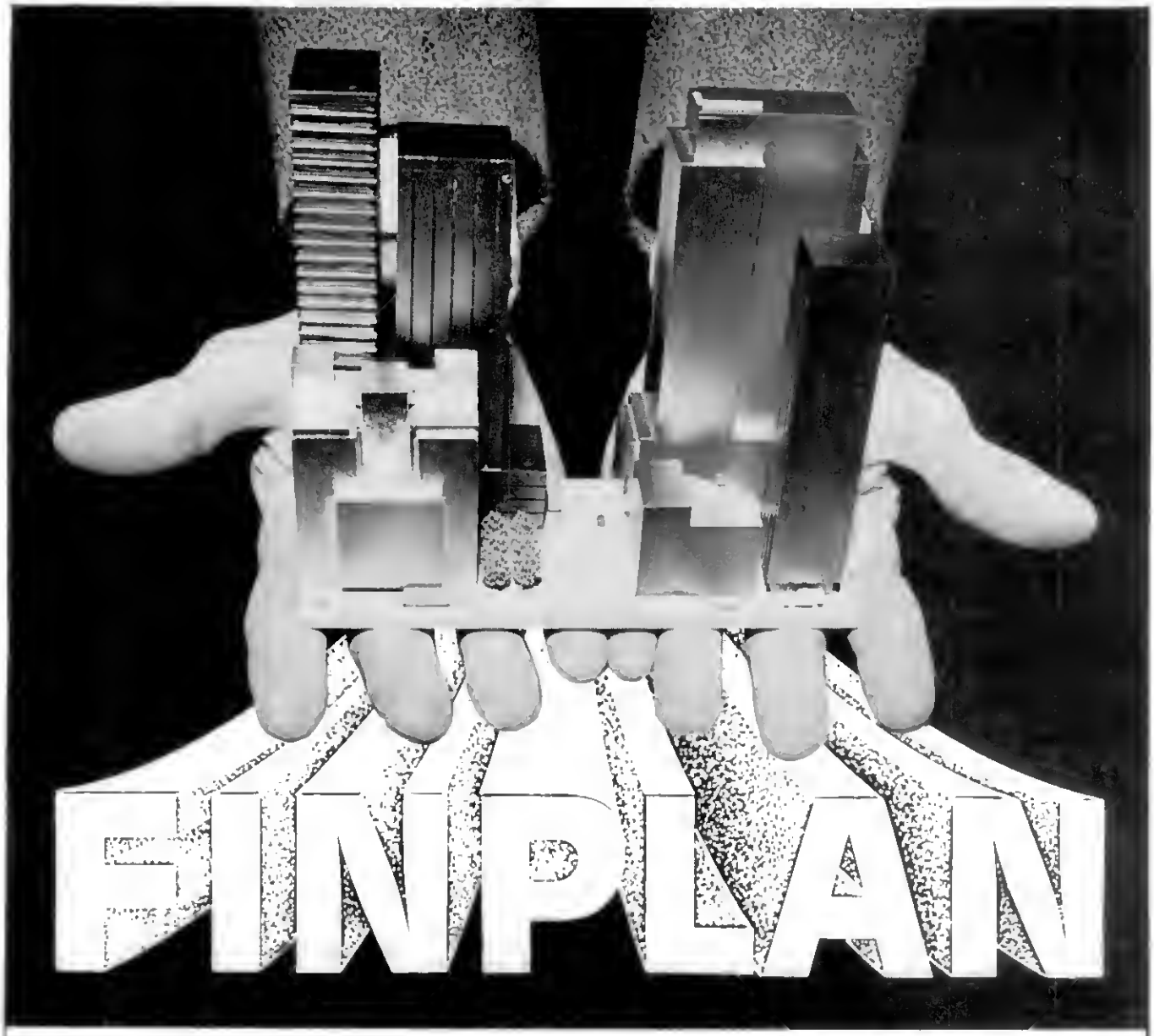
At CompuServe, where both terminals and micros fit into the network, Rich Baker, public relations coordinator, has a different perspective. "I think you're going to see information terminals catch on. Terminals are more consumer oriented. You don't need to know as much computer talk to operate them. And they'll be less expensive .... Tandy's target price for the Videotex terminal is $199. Plus, terminals are easy to hook up to networks.... Personal computers will still be providing something for those people who are interested in computing."

President Lewis Kornfeld suggests that Radio Shack may be considering other terminals. "Videotex is on the market by itself simply because it's come out before anything else. We are considering other things along the same lines, but it's a fast moving world out there—and hard to predict."

The Yankee Group released several of their forecasts prior to a recent symposium on The Home Information Utility. If they are correct, the computerized home environment of the near future will be similar to the home described by E. M. Forster in "The Machine Stops." In their newsletter, *Yankee Ingenuity*, they printed the following example of the effect of computer networks on daily life:

> "You will have programmed your home that you are awake. Your flat screen television monitor will switch on... it will tell you that you are scheduled to depart on AA Flight 156 to San Diego. Your home will have already called the Sabre System and found that the departure time is delayed 40 minutes. It will tell you the best route to the airport to avoid the traffic, the weather in San Diego, your agenda for the day, who you are meeting, and the overnight quarterly results of your division."

Back in the networks and information communications of the present, your hypothetical friend on the West Coast has posted a response to your cryptogram: "*Vive les* digits!" ■



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Into the 80's

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Now that we've been over the methods of CSAVE and CLOAD, we can take steps which lead to longer programs. I am going to explain the programming methods which you'll find in longer programs, and show some short examples which you can use in programs of your own.

Are you ready for the Force? The instructions we're going to look at this month are among the most powerful instructions in BASIC, and your TRS-80 has one of the most complete BASICs I know.

The IF...THEN Statement

The IF...THEN...ELSE instruction allows a computer to make a comparison and a decision. The comparison will be between two quantities, strings or numbers, and the decision will be about what to do next. The best way to show how this works is with an example (Listing 1). Let's go through it carefully.

Lines 10 through 60 print out the rules of a very simple game. A lot of improvements can be made, and we will need to make them if we want the game to be interesting, but for the moment, let's take just one step at a time.

The new parts of the program start at lines 70 through 90. The program prints the word LION and waits for your reply to be typed and ENTERED in line 80. The reply which you type becomes the variable N$, which can now be compared with the correct answer, which is the word PRIDE. Line 90 does just this: If you typed PRIDE, correctly spelled, then N$ = "PRIDE", and the program will print the words WELL DONE and end.

If you typed anything but PRIDE, the rest of line 90 is ignored, and the program shifts to line 100 to tell you that your answer is wrong. You are then asked to try again, and the program returns to line 70 by using the command GOTO 70.

Try it, giving a correct answer on one run and an incorrect answer on the next run, so you can see how the computer treats these different cases.

Meanwhile, whet about ELSE, which only a few computers feature in their BASIC? The BASIC statement in line 90 used only IF ...THEN. *If* N$ = "PRIDE", *then* the program goes on to complete the other instructions in line 90. *If* N$ is not "PRIDE", *then* the rest of line 90 is ignored and the next line executed is line 100. That last section of line 90 is rather important, incidentally. If you omit the :GOTO 120, when you answer PRIDE the computer would print:

```
WELL DONE
WRONG, I'M AFRAID—TRY AGAIN
LION ?
```

A correct answer should stop this simple program, and only an incorrect answer should permit the entry of another answer. You have to remember when you write a program that unless you command it otherwise, the program will always step from one line to the next in numerical order.

The ELSE Command

That big, big BASIC of the TRS-80, however, lets you write lines 90 through 120 in a much shorter form, which is shown in Listing 2. This can now be the last line in the program. Type in DELETE 100-120, hit ENTER and then type in your new line 90. Try it; this time, if N$ is not "PRIDE", the rest of the line is ignored only as far as ELSE, then the section after ELSE is carried out. Using IF-THEN-ELSE in this way can save a number of lines in your program.

Computer Comparisons

In addition to the use of IF-THEN-ELSE, another innovation is the use of the equality sign in the expression IF N$ = "PRIDE". This is not quite the same use of the equality sign that we've used until now. When we have a command like IF N$ = "PRIDE", the computer compares the two stored strings, N$ and PRIDE, letter by letter, to determine whether they are identical. If one string has a space or a comma or a period and the other hasn't, then they're not identical. We'll later look at ways around that problem.

The equality sign comparison isn't the only one which can be made. We can also write IF N$ > "PRIDE" or IF N$ < "PRIDE", though these statements would not be used in this game. The > sign means greater than, and when it's applied to a string it means that the word used for N$ would come later in an alphabetical index than the word PRIDE. For example, if N$ = "ROAR", then it comes later in a list than PRIDE, because R follows P in the order of the alphabet. If N$ = "PRUDENT", it also comes later, because U comes after I in the alphabet, even though both words start with PR. The < sign means less than, and

"Some owners of other computers would give both ears and a tail for the TRS-80's edit facilities."

works exactly in ravarse. To complata tha story, we can combina thasa aymbols as shown in Tabla 1.

Clearing Methods

Since we're writing programs of 12 lines and mora, we need to be able to clear one program (aftar using CSAVE to preserva it) in ordar to atart all ovar again with another program. Type NEW and hit ENTER —it's that easy. This doesn't actually arasa tha program the way you can arase a tape, it arasas only the instructions inside tha computar which act as a signpost to tha start of tha program. Your old program is completely wipad out when you enter a naw ona of tha sama langth or longar, or whan you switch the computer off and on again later.

Soma owners of othar computars would give both ears and a tail for the TRS-80's edit facilities. Wa're not going to covar all of tha editing methods at once, but it's time you met the main one.

With your program sat up, type EDIT 70 and hit ENTER. This will rasult in the number 70 being displayed on the screen with a cursor (dash mark) beside it. Prass the spaca bar and raleasa it, and the cursor moves right. Press again, and the first letter of PRINT appears. Another press and the second letter appears. Looks as if you're typing all these lattars with the spaca bar, doesn't it? Tha backshift arrow (←) allows you to go back until just tha number shows, the space bar allows you to go forward to show mora of tha instruction.

Space bar your way to the end of the line and than back spaca until the last quotation marks disappaar but you can still saa the antire word LION. Prasa tha lattar I on the keyboard, but don't hit tha ENTER kay. Backspaca until tha L of LION disappears, laaving only the first quotation marks visibla. Now typa tha word WHALE and hit ENTER. The lina should raad:

```
70 PRINT "WHALE"
```

The new word has been inserted (I for INSERT) batween quotation merks. In this axample, we first had to delata by backspac-

Sign	Meaning
=	exactly equal to
A<B	A lass than B (earlier in the alphabet)
A>B	A more than B (later in alphabet)
A<>B or A><B	A not equal to B
A<=B	A less than or equal to B
A>=B	A more than or equal to B

Tabla 1

```
10 CLS
20 PRINT@26,"COLLECTIVES"
30 PRINT:PRINT"I SHALL GIVE YOU THE NAME OF A CREATURE.
   "
40 PRINT"I SHALL THEN ASK YOU THE NAME FOR A GROUP OF S
   UCH CREATURES"
50 PRINT"FOR EXAMPLE - WOLF"
60 PRINT "YOUR REPLY SHOULD BE - PACK.  NOW TRY ---"
70 PRINT "LION"
80 INPUT N$
90 IF N$="PRIDE" THEN PRINT "WELL DONE":GOTO120
100 PRINT "WRONG, I'M AFRAID - TRY AGAIN"
110 GOTO 70
120 END
```

Program Listing 1

```
90 IF N$="PRIDE" THEN PRINT "WELL DONE":END:ELSE PRINT
   "WRONG - I'M AFRAID, TRY AGAIN":GOTO70
```

Program Listing 2

```
10 CLS
20 PRINT@26,"COLLECTIVES"
30 PRINT:PRINT"I SHALL GIVE YOU THE NAME OF A CREATURE"
40 PRINT"I SHALL THEN ASK YOU THE NAME FOR A GROUP OF S
   UCH CREATURES"
50 PRINT"FOR EXAMPLE - WOLF"
60 PRINT"YOUR REPLY SHOULD BE - PACK.  NOW TRY------"
70 READ Q$,A$
80 PRINT Q$
90 INPUT N$
100 IF N$=A$ THEN PRINT "WELL DONE":GOTO 70:ELSE PRINT
   "WRONG, I'M AFRAID - TRY AGAIN":GOTO80
110 DATA "LION","PRIDE","WHALE","SCHOOL","FISH","SHOAL"
   ,"SHEEP","FLOCK","COWS","HERD","GEESE","GAGGLE"
```

Program Listing 3

```
10 CLS:A=0:S=0
20 PRINT@26,"COLLECTIVES"
30 PRINT:PRINT"I SHALL GIVE YOU THE NAME OF A CREATURE"
40 PRINT"I SHALL THEN ASK YOU THE NAME FOR A GROUP OF S
   UCH CREATURES"
50 PRINT"FOR EXAMPLE - WOLF":PRINT"YOUR REPLY SHOULD BE
   - PACK"
60 PRINT"YOU ARE ALLOWED THREE TRIES. AFTER THE THIRD I
   NCORRECT ANSWER":PRINT"YOU WILL BE SHOWN THE CORRE
   CT ANSWER AND ASKED THE NEXT QUESTION"
70 READ Q$,A$:T=1
75 IF Q$="Z" THEN 120
80 PRINT Q$:IF T=4 THEN PRINT "ANSWER IS ";A$;:PRINT:GO
   TO70
90 INPUT N$:A=A+1
100 IF N$=A$ THEN PRINT "WELL DONE":S=S+1:GOTO70:ELSE P
   RINT "WRONG, I'M AFRAID - TRY AGAIN":T=T+1:GOTO80
110 DATA "LION","PRIDE","WHALE","SCHOOL","FISH","SHOAL"
   ,"SHEEP","FLOCK","COWS","HERD","GEESE","GAGGLE","Z
   ","Z"
120 PRINT:PRINT"YOUR SCORE IS ";S;" IN ";A;" ATTEMPTS":
   END
```

Program Listing 4

ing after the I had been pressed, but it's also possible to add letters, spaces or whole words into a line by using the I key and then typing in the new material. You can alter a line as much and as often as you like in this manner, but if you interrupt a program to alter a line, you will have to reRUN the program from the beginning.

Now that we've changed line 70, we need also to change line 90. Type EDIT 90 and hit ENTER. Use the space bar to step along to the E of PRIDE, then press the I key. Step back, using the back arrow, until the P of PRIDE has disappeared, then type in SCHOOL and hit ENTER. Line 90 should now have "SCHOOL" in the place of "PRIDE", and the program makes sense again.

Increase the Beasts

One of the problems of our program in Listing 1 is that it's limited, to say the least; not the sort of thing that's likely to hold your interest on a long rainy afternoon. Perhaps we can use a new instruction to pep things up a bit, starting with a method for using more animals.

Look now at Listing 3. There's a new instruction in line 70, READ Q$,A$. The READ instruction tells the computer to look for data, and the data must always be labeled by starting with the word DATA. There's no comma after DATA, but there must be a comma after each word in the list except for the last one. Because we're asking the computer to read string variables from this list, we have to enclose each word in the list within quotations. Where the comma after each word is *not* inside quotation marks, it indicates to the computer where each word ends.

In line 70 the computer assigns values to the string variables Q$ and A$. First time around, it makes Q$ identical to LION and A$ identical to PRIDE. To do this, the computer simply makes the first string variable, which is Q$, equal to the first word read from the data line, and the second string variable, A$, equal to the second word read from the line. We can have a line 70 which looks like this:

```
70 READ Q1$,A1$,Q2$,A2$,Q3$,A3$
```

This would have read three sets of question and answer words, or we could have read all six sets in one operation.

As it is, we chose to read just one question and one answer in line 70, and in line 80 we print the question word. Since Q$ is assigned to LION in line 70, that's what comes up on the video screen. We don't ask for the answer word (A$) to be printed, so it isn't. At line 90 you're asked to input your answer, and line 100 then compares your answer with one, PRIDE, which has been taken from the list.

We've made a few changes in line 100, also. If your guess is correct it is announced on the video screen, and the instruction GOTO70 tells the computer to read another pair of words. That's what makes this READ ...DATA pair of instructions so useful, each READ is a new one, with new information coming in from the data line or lines. This time, Q$ is set equal to WHALE, and A$ is set equal to SCHOOL. See why we call these quantities variables? We vary whet they are set to each time, instead of leaving them set for all time.

Looks a bit more interesting now, doesn't it? You can use as much data as your computer has space for (and your typing fingers will really ache before you fill up the 16K TRS-80 with data). Your TRS-80 won't let you type more than e total of 255 characters

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for the TRS-80 Model II* Computer

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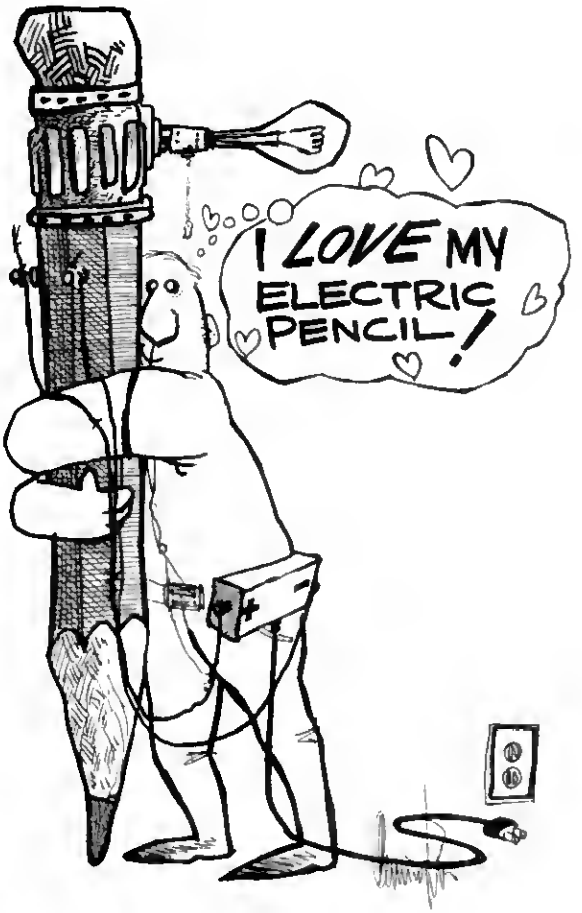

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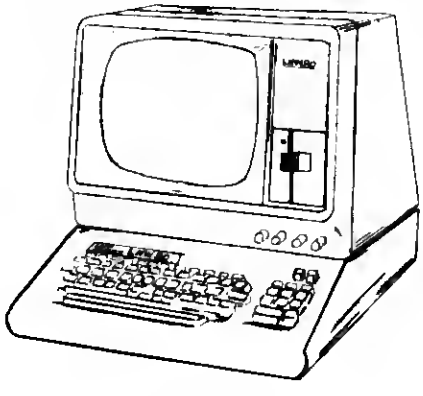

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on a line, so if your words (or numbers, of course, if you use number data) need another line. . .

There are rules about this, as you might expect. The last word in a line must not have a comma following it, and the next line must start with a line number which is greater than the line number of the previous line. After the line number, you must type in the word DATA, then the first data word for the line, a comma, the next data word and so on.

The computer always reads the data in order, starting with the lowest numbered line. There is no simple command which will fetch word number six, for example, although such a command would be very useful to have. Later we'll see how we can get around this limitation.

We still don't have a really satisfactory program yet. For one thing, there's no end to the program. It simply reads data until the last word has been read, and then you get an error message — OD (out of data). If you can't answer one of the questions, the program simply sticks, going back to line 80 from line 100 until you answer correctly or switch off in disgust.

Change Your Game

We need a few changes. First, we need to be able to stop the program when all six sets of words have been used. Secondly, we need to be able to limit the number of wrong answers so that the program doesn't stick. Finally, it would be useful to keep some sort of score.

You may not realize it, but you know one method by which to make these changes. The obvious method is to use counting variables which start at zero or unity and are increased by one (incremented) at each loop of the program.

Start by counting the number of times a set of questions and answers is read from the lines. Do we need to count this? Counting is one way of solving the problem, but there's another one: Put in a final pair of data items, and make the computer reject them. There's no animal called Z, and it doesn't hunt in Zs, so we can add Z,Z to the end of the line. We don't want to print Z, so we'll intercept this data, called a terminator, between reading in line 70 and printing in line 80:

```
75 IF Q$ = "Z" THEN END
110 DATA "LION","PRIDE",. . . ."GEESE","GAGGLE","Z","Z"
```

We have to put both Zs in the line, because the READ statement in line 70 always reads two strings. If there's only one, we'll get that OD error message again. This is a much more satisfactory way of terminating a read than by counting the number of sets of reads, because it lets us add to the data easily, by inserting more data between the gaggle and the Z; if we had used a count, we should also have to change the count number.

We now have the problem of the program looping around line 80 through 100 and back when you can't answer. Let's allow three tries only, and if all are wrong, we print the correct answer and fetch the next pair of words.

How do we do that?

First of all, we must select a letter to represent the number of tries; T looks useful, as it will remind us of t for try. A letter which reminds you of what you are trying to do makes life a lot easier when you are designing and redesigning the program, or when someone else is trying to understand it. We want to allow one attempt whenever a pair of names is read, so we need to make T take the value of unity each time data is read.

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EDIT line 70 to:

```
70 READ Q$, A$: T = 1
```

and T will be correctly set at each read step.

Now we want to add one to T each time you answer incorrectly. We can do that by altering line 100 (which is lengthening every time we alter this program), to read:

```
100 IF N$ = Q$ THEN PRINT "WELL DONE":
GOTO 70 : ELSE PRINT
"WRONG, I'M AFRAID - TRY AGAIN":
T = T + 1 :GOTO 80
```

After our third attempt, T will have the value four. We now need to arrange for this to cause the program to break out of its loop.

If T is less than four, line 80 should print Q$ and ask for an input reply. If T is equal to four, we want to print the correct answer and start with another pair of words. It looks like a convincing case for an IF...THEN statement. Suppose we make line 80 read:

```
80 PRINT Q$ : IF T = 4 THEN PRINT
"ANSWER IS";A$:PRINT:GOTO 70
```

If you've had three attempts, the answer is printed and a new animal question is asked. In line 70 T is again set to 1, so the next time the program goes to line 80 the new piece of program is ignored again. We've printed the words and the variable A$ in the new section of line 80 using a semicolon to keep the video display running on the same line. (We could have used T = 1 in line 70 and IF T = 3 in line 80.)

The next item on the list is a way of keeping score. To be fair, we need to keep a tally of the number of total attempts and the number of successful attempts. Each time we've been successful, we've printed WELL DONE, so we could make a count of the successful attempts there. Each time we answer, we input something on line 80, so the total number of attempts could be counted there.

Let's use the variable A for the number of attempts. We have to start at zero, so A must be set to zero early in the program. Line 10 is fairly empty, and we can add, after a colon, A = 0. To count the attempts, line 90 needs another addition: A = A + 1 so that A is increased by one each time you answer.

If we use S to count successes, we can set S = 0 in line 10, and increment it just after the statement PRINT "WELL DONE" in line 100:

```
100 IF N$ = Q$ THEN PRINT "WELL DONE":
S = S + 1:GOTO 70: ELSE
PRINT "WRONG,I'M AFRAID - TRY AGAIN":
T = T + 1:GOTO 80
```

Finally, having counted attempts and successes, we better make some use of them. When the last pair of items (the terminators) has been read, we can print the scores instead of just finishing the program. This is done by adding line 75:

```
75 IF Q$ = "Z" then 120
```

and in line 120, printing the score.

In case you're getting a bit lost with all these changes, Listing 4 shows what the program now looks like. The program which started as a very simple game is now more advanced, and does its own scoring as well.

Add Excitement with FOR-NEXT

The game will be much improved if we can arrange the program so that the computer can pick any animal at random and surprise you. We can't tackle that until we learn two other instructions.

The first is a really powerful one called the FOR-NEXT loop. Its purpose is to allow you to count the number of times an operation is carried out. For example, if we type in the instructions:

```
200 FOR N = 1 TO 6
210 READ S$
220 NEXT
```

a loop will be set up to read six items from a line somewhere else in the program. The first time the computer comes to line 200, it sets N at 1 and then in line 210 reads the first item, assigning it to S$.

There being no instructions about what to do with the item in this example, the computer goes to the next line—NEXT. NEXT means go back to the FOR instruction, and make N one step greater. The size of the step, unless you instruct it otherwise, is 1. The next time round N is set to 2, and in line 210, the second item is read.

Once again we go to line 220, and the NEXT instruction compares the value of N (now two) with the limit we set (which was six) and returns the program to line 200. This loop repeats until the NEXT instruction makes N = 7. This stops any return to line 200, so that the program goes on to the next line.

The example we've used is a fairly simple one, with very few instructions between the FOR and the NEXT. We could, in fact, write such a short piece of program on one line:

```
200 FOR N = 1 TO 6 : READ S$ : NEXT
```

and we don't have to worry about having to set up a comparison like:

```
210 IF N<=6 THEN 200 ELSE 220
```

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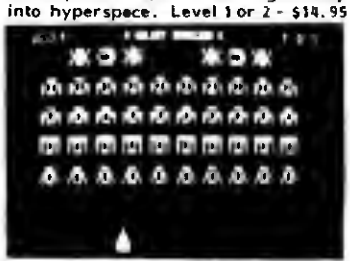

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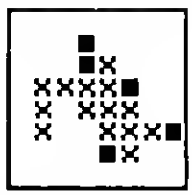

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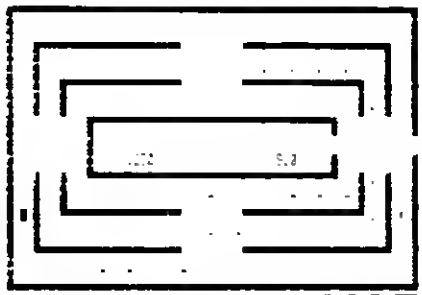

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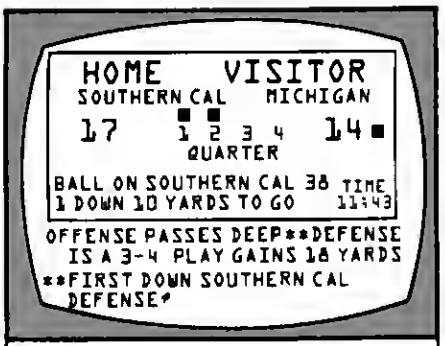

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en instruction means it does a lot of program work without needing much typing. The amount of work it does can be judged from the time it takes. As an example, and so that you can see the FOR-NEXT loop doing something, try the program in Listing 5. Use a digital watch to measure the time between pressing ENTER on this one liner and getting the READY signal back, and watch the line printing out. FOR-NEXT loops are often used deliberately in programs to create a time delay, such as to give you a definite time to answer a question before moving on to the next one.

BASIC Info

There's a routine built into the BASIC language which picks numbers randomly for any number limits you like to use. The command is RND, and what makes it so useful (not just for games, incidentally) is that it can be followed by a whole number (an integer) in brackets. The result will be an integer picked at random which lies between one and the number you used in the brackets. For example, RND(6) should cause the computer to come up with a random whole number between one and six.

We have a data list of six items and can produce a random number between one and six. It would be useful if that random number could be used to select the corresponding item of data. For example, if RND(6) came up two, the second item from the list would then be selected, and so on.

There's no such instruction in BASIC so we have to look for ways around this problem. Suppose the random number came up three. Could we perhaps read the data list three times, and use the last item only? We could indeed, and that's what the first sample FOR-NEXT program did.

Take a look now at Listing 6. There's a new line in the old program, line 65. At the start of line 65, T, the number of times you've tried, is set at 1. We had to shift it because our new program is going to read data in several times before it actually prints an animal name, and we don't need T set more than once each time. The next instruction in line 65 is Y = RND(6), which picks a number between one and six and allocates it to the variable Y. We can now use a FOR-NEXT loop, with the counting variable N counting from one to Y. You don't know yet what that number Y is, as it's going to be set and used by the computer itself.

The Anticipation Mounts

What happens on each loop? At a value of N set at one, the program moves to line 70, and reads the first two items (LION, PRIDE) on the list. There are no other instructions, so the NEXT command causes N to advance to two, and the next pair of

```
10 FOR N=1TO500:PRINT "JUST LOOK AT THIS...!":NEXT
```

Program Listing 5

```
10 CLS:A=0:S=0
20 PRINT@26,"COLLECTIVES"
30 PRINT:PRINT"I SHALL GIVE YOU THE NAME OF A CREATURE"
40 PRINT"I SHALL THEN ASK YOU THE NAME FOR A GROUP OF S
   UCH CREATURES"
50 PRINT"FOR EXAMPLE - WOLF":PRINT"YOUR REPLY SHOULD BE
   - PACK"
60 PRINT"YOU ARE ALLOWED THREE TRIES. AFTER THE THIRD I
   NCORRECT ANSWER":PRINT"YOU WILL BE SHOWN THE CORRE
   CT ANSWER AND ASKED THE NEXT QUESTION"
65 T=1:Y=RND(6):FOR N=1TOY
70 READ Q$,A$:NEXT:RESTORE
75 IF Q$="Z" THEN 120
80 PRINT Q$:IF T=4 THEN PRINT "ANSWER IS ";A$;:PRINT:GO
   TO65
90 INPUT N$:A=A+1
100 IF N$=A$ THEN PRINT "WELL DONE":S=S+1:GOTO65:ELSE P
    RINT "WRONG, I'M AFRAID - TRY AGAIN":T=T+1:GOTO80
110 DATA "LION","PRIDE","WHALE","SCHOOL","FISH","SHOAL"
    ,"SHEEP","FLOCK","COWS","HERD","GEESE","GAGGLE","Z
    ","Z"
120 PRINT:PRINT"YOUR SCORE IS ";S;" IN ";A;" ATTEMPTS":
```

Program Listing 6

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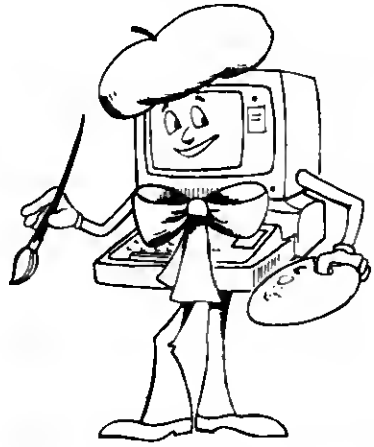

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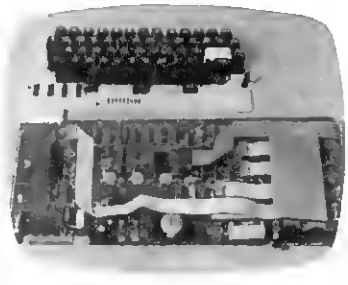

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items is read. Reading the next pair of items in this way automatically causes the previous values to be wiped out, just as recording a new item on a music cassette wipes out the one on it before. The value of the variable N will be increased by one on each run around this loop, until it equals Y, the random number. Suppose Y happens to be four. Then the fourth set of words is read, and the loop stops with O$ and A$ storing the fourth set of words, SHEEP and FLOCK.

The FOR-NEXT loop has stopped and the program moves to line 80, carrying out one very important instruction on the way. RESTORE causes the data selector to go back to the start of the data. Without RESTORE, the next time we look for a word, the data would be counted from where we left off first time, which doesn't leave much room for choice, since only a herd of cows and a gaggle of geese follow the flock of sheep. RESTORE sets everything back so that the next random number starts the search from the beginning of the data again.

For a simple game like this, let's view the score after each set of five answers.

We need to count a set of five items printed, and then show the score. We will set up another variable, (J) to act as a counter, and increment each time a question is printed. We want a way of telling when J is 5, 10, 15 or any other multiple of 5. We could have lines like:

```
200 IF J = 5 THEN-----
210 IF J = 10 THEN-----
220 IF J = 15 THEN-----
```

but that's a waste of time and memory. A much easier trick is to make use of yet another feature of that big BASIC in the TRS-80, the INT command. INT means rounding off a number by removing the fractional part. INT(6.25) is 6, INT(2.14) is 2 and so on. The way we're going to use INT is in a decision step:

```
IF INT J/5 = J/5 THEN-----
```

"Without RESTORE, the next time we look for a word the data would be counted from where we left off the first time, which doesn't leave much room for choice, since only a herd of cows and a gaggle of geese follow the flock of sheep."

We've now arrived at line 80, and the question word is printed as before. The rest of the program is also unchanged, so that if you answer correctly or have three unsuccessful tries, the program returns...or does it? You need extra eyes in this business. If we want the next word to come up, we need a new random number, else the program will go back to its old way of taking the next pair of data words. Instead of GOTO 70 in line 80 and 100, we want GOTO 65, and that should set things right.

The game's getting more interesting now, and it would be useful to have more items on the list, because with only six sets of items it's not much of a game. Our changes have made the Z,Z terminetor unnecessary. Because we're picking at random from six, there's no chances that Z will ever be picked, so we can remove these letters from line 110. We can also remove line 75.

How do we go about ending the game and reading the score? It would be useful to see the score any time we want and opt to continue or end.

The easiest way to understand how this works is to imagine taking values from one upwards. If J is 1, then J/5 is 0.2, and INT(J/5) is zero. J/5 certainly isn't equal to INT(J/5). For J = 2,3,4 we get the same effect; the INT value is zero, but for J = 5, when 5/5 = 1, and INT(5/5) also equals 1, the test succeeds.

At J = 6, J/5 = 1.2, and INT(J/5) = 1, and the two are unequal again until J = 10, when both J/5 and INT(J/5) are equal to 2. This test therefore allows us to detect each set of five steps of J.

If J/5 = INT(J/5) we want a score. We don't want the score to come up too quickly, so we'll introduce a time delay between each test, which will also delay the appearance of the score. To do this we can use:

```
FOR Z = 1 to 500: NEXT
```

Z doesn't mean anything to the program, it's just a variable which we're using for a time delay.

How do we use the test IF J/5 © INT(J/5)?

"It's at this stage that you can make a program look and run more professionally. . . ."

If the test fails, the ELSE at the end of the line directs the program to find another item. This will happen on the first four runs. When the test succeeds, and J/5 = INT(J/5), we've reached the fifth (or 10th, 15th, 20th. . . . .) item, and the screen is cleared and the score printed.

The next line is the new way of deciding whether to continue the game or stop. The question "DO YOU WANT TO CONTINUE" is asked, and instructions are given for answering. An answer of this type (Y or N) has to be followed by hitting ENTER; later on we'll look at methods of answering questions like this without using the ENTER key. I'm a card-carrying member of the Help Stamp Out Needless Key Pushing society, myself.

This looks like a good time to sit back and take a hard look at our program, which is possible only if you have a copy on paper. Short programs of 16 lines or less can be viewed on the video screen, but this one will not quite fit into 16 lines. For programs longer than this, the only effective way to check it is to print it on paper or to copy the listing from the video screen.

Shape-Up and Look Professional

A long hard look at our program as it is now shows that it needs renumbering. The odd numbered lines we added have inserted useful features into the program, but they make it look rather untidy. If we had a really long program here, the simplest way of renumbering would be to use a renumbering program. As we're remodeling the program with this new random selection feature, we might as well write out the program again, and renumber as we go. The result is shown in Listing 7.

It's at this stage that you can make a program look and run more professionally than most home-brewed efforts. One pointer is neat printing, with good tabulation and even lines, preferebly right justified. Right justified means that the ends of the lines on the right of the screen are lined up, and it has to be done by careful attention to the spaces between the words in the line. A professional programmer may spend as much time on tidying up the printing in a program as on the rest of the program.

The next item on the list is error traps. Professional programmers write programs which other people are going to use, and a good program should be user friendly and crash proof. User friendly means that when the user has to make some sort of choice, the questions should be put politely, and easy to answer.

For example, it's a whole lot friendlier to be asked to type YES or NO, than 1 or 2. Crash proofing is even more important, and means that every input from the user has to be tested. For example, if a YES or NO answer is called for, what happens if the user types YO or NES? A homebrew program might terminate, or worse still, it might take the answer as being YES or NO with no indication to the user. A much better way is to respond to a wrong answer with a statement such as:

```
"I'M SORRY—I DON'T RECOGNIZE THAT ANSWER";
N$;"PLEASE TYPE YES OR NO"
```

In this line, N$ would be the word which the user had typed, and the line would be followed by a GOTO instruction so that the choice was presented again.

Each request should be accompanied by a clear list of what the choices are, the user should be reminded of the choice, once made, and an unacceptable answer should be explained, with a return to the request. Making sure that this is all done is not so simple; it can take up a lot of time and needs a lot of careful thought. It also needs memory space.

It pays off handsomely in the end, however, because your program will always be a delight to run, easy for you or your friends to use, and a very attractive item if you want to sell it.

Speed It Up

A few final details will help the program to run faster. We'll spend more time on the different types of number variables in Part four of this series, but it's not giving secrets away to tell you that the TRS-80 can store numbers in three different forms. If you don't specify what you want, all number variables are stored as single precision numbers, as if they consisted of a number with several places of decimals. This takes up a lot more memory space than a simple whole number (an integer). If we can define all number variables as integers, our programs will run faster and use less memory. The program in Listing 7 uses a lot of number variables which could be defined as integers: A,S,T,Y,N,Z. By redefining them, we can clear enough string space for more data words. Alter line 10 to read:

```
10 CLEAR 100: DEFINT A,S,T,Y,N,Z:J=A=0:S=0:J=0
```

Notice that A and A$ are entirely different variables: one is a number variable which we've now defined as an integer, the other is a string variable which is an answer to e question.

How about taking the plunge for yourself and designing your own question and answer game? Remember that you will have to insert a larger number after CLEAR in line 10 if you use a lot of word pairs (the number should be equal to the number of characters, plus a bit in reserve). You will also have to change the title and instructions to fit your own ideas.

Next month—another small step for the TRS-80, a giant step for programmers.■

```
10 CLS:A=0:S=0:J=0
20 PRINT@26,"COLLECTIVES"
30 PRINT:PRINT"I SHALL GIVE YOU THE NAME OF A CREATURE"
40 PRINT"I SHALL THEN ASK YOU THE NAME FOR A GROUP OF S
   UCH CREATURES"
50 PRINT"FOR EXAMPLE - WOLF":PRINT"YOUR REPLY SHOULD BE
    - PACK"
60 PRINT"YOU ARE ALLOWED THREE TRIES. AFTER THE THIRD I
   NCORRECT ANSWER":PRINT"YOU WILL BE SHOWN THE CORRE
   CT ANSWER AND ASKED THE NEXT QUESTION"
70 T=1:Y=RND(6):FORN=1TOY
80 READ Q$,A$:NEXT:RESTORE
90 PRINT Q$:J=J+1:IF T=4 THEN PRINT"ANSWER IS ";A$:PRIN
   T:GOTO120
100 INPUT N$:A=A+1
110 IF N$=A$ THEN PRINT "WELL DONE":S=S+1:GOTO120:ELSE
    PRINT "WRONG, I'M AFRAID - TRY AGAIN":T=T+1:GOTO90
120 FOR Z=1TO500:NEXT:IF J/5=INT(J/5) THEN CLS:PRINT "Y
   OUR SCORE IS ";S;" IN ";A;" ATTEMPTS":ELSE 70
130 PRINT:PRINT "DO YOU WANT TO CONTINUE? TYPE Y FOR YE
   S, N FOR NO"
140 INPUT Z$:IF Z$="Y" THEN 70 ELSE IF Z$="N" THEN END
    ELSE 140
150 DATA "LION","PRIDE","WHALE","SCHOOL","FISH","SHOAL"
   ,"SHEEP","FLOCK","COW","HERD","GEESE","GAGGLE"
```

Program Listing 7

✓ Reader Service—see page 242

TRS-80* OWNERS:

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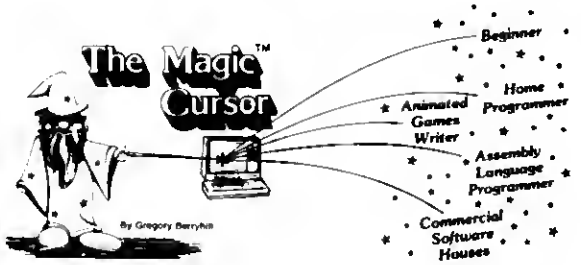

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A realty good game.

Computer Monopoly

Barry L. Adams
109 Valley Place
Greenville, NC 27834

Ever wonder what it would be like to play a game of Monopoly against your TRS-80? Well, here's your chance. This 16K, Level II program emulates a player in the classic Parker Brother's board game.

With the exception of a screen board no graphics are employed, as the entire complement of 16K memory is required by the program. The game consists of two separate programs, an instruction program and the main program. Though the instructions are easily understood, they don't include the rules to Monopoly.

Although the main program is called by the instruction program, it can be loaded independently. However, because of strict memory requirements when loaded independently, there is no initial opening title.

During the game, the TRS-80 participates as a player—buying, selling and trading real estate—out to make the best deal possible and win. It buys its own real estate, improves the property and charges more rent. It sells property and makes business deals like any other player would. It can also go bankrupt. When in a scrape, the computer will automatically mortgage some assets and settle the debt, only to rebuy the property when financially able.

The computer can roll the dice for any player. It also maintains a set of books that can be examined by any of the other players. Players make their business proposals directly to the computer. The game can be played with up to seven human players.

Because of memory requirements, the program has been written without spaces between the statements. Though this makes the listing somewhat difficult to read, the program is generally divided into blocks. Each block contains a single major routine or a group of related smaller routines. Table 1 should be helpful.

Generally speaking, I think you will find that the computer is a quite personable player. However, like any human player it can become rather fickle—especially when winning. ■

Lines 1-85:	a. initialize variable b. players' command display c. die rolls d. computer die roll analysis e. delay loop f. computer's books
Lines 100-199:	evaluation routine for computer-generated proposals (This routine calls elements of block 700.)
Lines 200-299:	a. computer mortgages real estate and improvements b. settles debts c. rebuys mortgaged property and improvements
Lines 400-499:	construction routine to erect houses and hotels
Lines 500-599:	player propositions
Lines 600-699:	player proposition evaluation (This routine calls elements of block 100.)
Lines 700-799:	a. the basic game utility. The routine tracks the disposition of all property and improvements. b. computer cash offers for real estate
Lines 800-899:	a. computer in jail b. income tax routine
Lines 900-999:	a. Chance and Community Chest routines b. account deductions c. account credits d. get out of jail free

Table 1.

Program Listing 1: The Instructions for Monopoly

```
20 CLS:PRINT:PRINT:GOTO508
25 CLS:PRINTTAB(17);"$  THE MONOPOLY PLAYER  $":PRINT
50 PRINT"  WELCOME TO COMPUTER-MONOPOLY. THIS PROGRAM A
LLOWS YOUR TRS-80 TO BECOME A FULLY PARTICIPATING PLAYE
R IN THE EVER POPULAR BOARDGAME, MONOPOLY." THE GAME IS
 ";
55 PRINT"PLAYED USING THE RULES, BOARD,MONEYAND PLAYING
 PIECES OF THE CONVENTIONAL GAME. FOR CONVIENCE THE  CO
MPUTER SHOULD BE LOCATED AS CLOSE TO THE BOARD AS POSSI
BLE. A TOKEN SHOULD BE USED TO REPRESENT THE COMPUTER."
;
56 PRINT" IF IT'S BEEN A  WHILE SINCE YOU'VE PLAYED FRI
ST RE-FAMILIARIZE YOURSELF WITH THERULES WHICH ACCOMPAN
Y THE BOARD GAME BEFORE BEGINNING.":GOSUB488:PRINT"  PL
AY PROCEEDS IN THE NORMAL MANNER WITH THE PLAYERS MOVIN
G ,";
57 PRINT"  BUYING PROPERTY AND JUST IN GENERAL WHEELING
 AND DEALING. THE  ONLY EXCEPTION IS THAT ONE OF THE P
LAYERS JUST HAPPENS TO BE A  COMPUTER."
58 PRINT"  IN AS MUCH AS A KITTY IS OFTEN USED THE COMP
UTER WILL SPECIFY THAT ALL TAX PAYMENTS, FINES ETC. BE
PAID TO THE KITTY.";
60 PRINT" SHOULD  YOU NOT USE A KITTY ,SIMPLY REGARD AL
L REFERRAL TO THE KITTY AS MEANING THE BANK.":PRINT"  T
HE COMPUTER WILL COLLECT PROPERTY DEEDS JUST LIKE THE O
THER  PLAYERS, HOWEVER, THE COMPUTER DOES NOT USE PLAY
MONEY.";
65 PRINT" PLAYERS DEALING WITH THE COMPUTER MAKE DEPOSI
TS AND WITHDRAWALS DIRECTLYTO AND FROM THE BANK."
```

Program continues

```
70 PRINT:PRINTTAB(10);"PRESS ENTER TO CONTINUE";:INPUTA

80 CLS:PRINT"  PLAYERS INTERACT WITH THE COMPUTER THROU
GH SEVEN POSSIBLE       OPERATIONS:";PRINT:PRINTTAB(16)
;"PLAYER TRANSACTIONS ..... 1";PRINTTAB(16);"PLA
YER CHANCE/DEBT ..... 2":PRINTTAB(16);"PLAYER P
ROPOSITION ..... 3"
85 PRINTTAB(16);"DIE ROLL ..... 4":PR
INTTAB(16);"MY TURN ..... 5":PRINTTA
B(16);"POS/COR ..... 6":PRINTTAB(16)
;"LEDGER ..... 7"
90 PRINT:PRINT"  THE OPERATIONS  ARE PREFORMED SIMPLY B
Y STRIKING THE":PRINT"APPROPIATE NUMBER KEY. IT IS NOT
NECESSARY TO PRESS ENTER."
100 PRINT:PRINTTAB(10);"PRESS ENTER TO CONTINUE";:INPUT
A
110 CLS:PRINT"OPERATION #1 IS USED TO INFORM THE COMPUT
ER OF ANY CHANGES IN   PROPERTY OWNERSHIP OTHER THAN TH
OSE OF THE COMPUTER.IN ORDER TO EXPEDITE THE PLAY OF TH
E GAME A PROPERTY IDENTIFICATION CODE IS USED IN LEIU O
F";
120 PRINT" TYPING IN PROPERTY NAMES.":PRINT" THE ID COD
E IS SIMPLY THE NUMERICAL POSITION OF EACH LOT ON THEBO
ARD. FOR EXAMPLE , BEGINNING WITN GO AND TRAVELING IN T
HE":PRINT"DIRECION OF PLAY MEDITERRANEAN AVENUE IS ID#
1";
125 PRINT" READING RAILROAD IS ID# 5, FREE PARKING IS I
D# 20, AND THE COMMUNITY CHEST SQUARELOCATED JUST AFTER
, GO-TO-JAIL IS ID# 33. GO IS ID# 0.";
130 PRINT"SIMILARILY, EACH PLAYER IS NUMERICALLY CODED;
 PLAYER 1 IS #1, PLAYER 2 IS #2 ECT. THERE CAN BE A MAX
IMUM OF 7 HUMAN PLAYERS.":PRINT:PRINTTAB(10);"PRESS ENT
ER TO CONTINUE";:INPUTA:CLS
140 PRINT"  WHEN OPERATION #1 IS REQUESTED THE COMPUTER
 WILL PROVIDE THE  PRONPT - 'PLAYER' TO WHICH THE PLAYE
R ID# IS TYPED. THE COMPUTERWILL THEN RETURN A SECOND P
RONPT";
145 PRINT" - 'GETS' TO WHICH THE PROPER   PROPERTY ID C
ODE IS ENTERED. THE BANK OR BOARD IS ID# 0 WHILE   THE
COMPUTER IS ID# 9. SHOULD A MISTAKE BE MADE DURING INPU
T    SIMPLY RE-ENTER THE INFORMATION AND MAKE THE CORRE
CTION.";
150 PRINT" EACH   PROPERTY MUST BE ENTERED INDIVIDUALLY
."
155 PRINT:PRINT"  OPERATION #2 , PLAYER CHANCE/DEBT, IS
 USED TO INFORM THE      COMPUTER OF ANY ADJUSTMENT TO
IT'S BANK ACCOUNT RESULTING FROM  THE PLAY OF THE GAME
BY THE OTHER PLAYERS.";
160 PRINT" PROVISIONS ARE MADE  FOR BOTH DEPOSITS AND D
EDUCTIONS.":PRINT:PRINTTAB(10);"PRESS ENTER TO CONTINUE
";:INPUTA:CLS
170 PRINT"  OPERATION #3, PLAYER PROPOSITION, IS THE ME
ANS USED BY PLAYERS TO PROPOSE TRADES, SALES ETC. TO TH
E COMPUTER.":PRINT
180 PRINTTAB(10);"TRADE ..... 1":PRINTTA
B(10);"TRADE/MONEY ..... 2":PRINTTAB(10);"TRAD
E/OTNER PROPERTY ..... 3":PRINTTAB(10);"TRADE/MONEY/PRO
PERTY ..... 4":PRINTTAB(10);"PURCHASE .....
 5"
190 PRINT:PRINT"  THE COMPUTER WILL PROMPT FOR THE SPEC
IPIC INFORMATION REQIURED FOR EACH OF THE 5 CATAGORIES
OF PROPOSITIONS. IN EACH INSTANCE IT WILL ASK THAT THE
ID CODE FOR THE INVOLVED PROPERTIES BE     ENTERED.";
193 PRINT:PRINTTAB(10);"PRESS ENTER TO CONTINUE";:INPUT
A:CLS
195 PRINT"  THE COMPUTER WILL CONTINUE TO PROVIDE THE P
ROMPT - 'LOT#' FOR ADDITIONAL ENTRIES. PRESSING THE ENT
ER KEY TELLS THE COMPUTER   THAT THERE ARE NO MORE ENTR
IES.";
198 PRINT" THE COMPUTER WILL THEN BRIEFLY  SUMMARIZE TH
E PROPOSITION AND ASK THE PLAYER IF IT'S UNDER-";PRINT"
STANDING IS CORRECT. IT THEN PERFORMS AN EVALUATION AND
 INFORMS THE  PLAYER ACCORDINGLY."
200 PRINT:PRINT"  OPERATION #4, DIE ROLL, ALLOWS THE CO
MPUTER TO ROLL THE DICE  FOR THE PLAYERS AND IS OPTIONA
L. IT CAN BE USED ANY TIME BY ANY HUMAN PLAYER. IT KEEP
S UP WITH THE NUMBER OF TIMES THE PLAYER   ROLLS DOUBLE
S DURING THE TURN."
205 PRINT:PRINTTAB(18);"PRESS ENTER TO CONTINUE";:INPUT
A:CLS
210 PRINT"  OPERATION #5, MY TURN, INITIATES THE COMPUT
ER'S TURN WHICH    CONSISTS OF:";PRINT:PRINTTAB(10);"1
CHECKING TO SEE IF ANYTHING IS IN MORTAGE";PRINTTAB(10)
;"  AND REBUYING IF ABLE":PRINTTAB(18);"2 MAKING PROPOS
ALS TO OTHER PLAYERS"
215 PRINTTAB(10);"3 IMPROVING PROPERTY IF ABLE":PRINTTA
B(10);"4 ROLLING DICE AND RESPONDING TO SITUATION
220 PRINT:PRINTTAB(18);"PRESS ENTER TO CONTINUE";:INPUT
A:CLS
230 PRINT"  OPERATION #6, POS/COR,( POSITION/CORRECTION
 ) IS USED TO":PRINT"INFORM THE COMPUTER THAT IT'S POSI
TION ON THE PLAYING BOARD IS  BEING ADJUSTED. THIS MOVE
MENT IS NON-ROUTINE AND NORMALLY IS NOTHECESSARY. FOR E
XAMPLE, SHOULD IT BECOME NECESSARY";
240 PRINT" TO POWER DOWNTHE COMPUTER PRIOR TO THE END O
F A GAME OPERATIONS 1,2 AND 6 CANBE USED TO RECONSTRUCT
 THE GAME.":PRINT
250 PRINT"  OPERATION #7, LEDGER, ALLOWS HUMAN PLAYERS
TO FULLY EXAMINE   THE COMPUTER'S ASSETS.":PRINT:PRINTT
AB(18);"PRESS ENTER TO CONTINUE";:INPUTA:CLS
260 PRINT"  DURING THE PLAY OF THE GAME, THE COMPUTER,
LIKE ALL OTHER     PLAYERS WILL OCCASSIONALLY LAND ON C
HANCE AND COMMUNITY CHEST.  UPON DOING SO THE COMPUTER
WILL ASK THAT SOMEONE DRAW THE TOP   CARD FROM THE APPR
OPIATE STACK AND DEPENDING UPON";
270 PRINT" THE CONTENTS  OF THE CARD PERFORM ONE OF THE
 FOLLOWING OPERATIONS:":PRINT
280 PRINTTAB(10);"1 STREET ASSESSMENT":PRINTTAB(18);"2
AN ACCOUNT DEDUCTION":PRINTTAB(10);"3 AN ACCOUNT DEPOSI
T":PRINTTAB(18);"4 A GET OUT OF JAIL FREE CARD":PRINTTA
B(10);"5 A BOARD ADVANCMENT":PRINTTAB(18);"6 GO BACK 3-
SPACES":PRINT
285 PRINTTAB(18);"PRESS ENTER TO CONTINUE";:INPUTA:CLS
290 PRINT"  ALL CARD COMMANDS EXCEPT 2 AND 3 ARE SPECIA
L PURPOSE COMMANDS.AS IN THE CASE OF THE GENERAL OPERAT
ION COMMANDS, COMMANDS¬S 2 AND3 ARE USED TO MAKE DEPOSI
TS AND WITHDRAWLS TO AND FROM THE COMP-UTER'S BANK ACCO
UNT.";
293 PRINT" THE REHAINING CARD COMMANDS SHOULD ONLY BE U
SED FOR THE INDICATED PURPOSE. COMMAND 5, BOARD ADVANCE
MENT, ISUSED FOR 'GO TO JAIL', 'ADVANCE TOKEN TO NEARES
T UTILITY' ETC."
310 PRINT:PRINT"  IF YOU WOULD LIKE TO REVIEW THE INSTR
UCTIONS ENTER 1 ELSE TO  LOAD THE MAIN PROGRAM PRESS 'P
LAY' ON THE RECORDER AND THEN     PRESS ENTER. THE GAME
 PROGRAM WILL BEGIN LOADING IMMEDIATELY.   ONCE LOADING
 IS COMPLETE THE FAMILIAR >READY ";
315 PRINT"WILL APPEAR. TYPE  RUN.THE PROGRAM REQUIRES J
UST A FEW MOMENTS TO SET ALL VARIABLESAFTER WHICH THE G
AME MENEU IS DISPALYED":B=8:PRINT:PRINTTAB(25);:INPUT"T
HE END";B
320 IFB>0,5 ELSE 458
400 PRINT:PRINT"*  MONOPOLY IS A REGISTERED TRADEMARK O
F THE PARKER BROTHERS    COMPANY":PRINT:PRINTTAB(10);"P
RESS ENTER TO CONTINUE";:INPUTA:CLS:RETURN
450 CLS:A=1:PRINTCHR$(23);STRING$(32,"*");"*";TAB(31);"
*";TAB(31);"*";TAB(31);"*";TAB(31);"*";TAB(31);"*";

500 PRINTCHR$(23);STRING$(32,36);"*";TAB(7);"THE MONOPO
LY PLAYER";TAB(31);"*";STRING$(32,36);:IF A<>1,505 ELSE
 PRINT"*";TAB(31);"*";TAB(31);"*";TAB(31);"*";TAB(31
);"*";TAB(31);STRING$(33,"*");
501 PRINT@602,;:CLOAD
505 PRINT:PRINT:PRINTTAB(9);"INSTRUCTIONS":PRINT:PRINT:
PRINT:PRINTTAB(4);"PRESS ENTER TO BEGIN";:INPUTA:GOTO25
```

Program Listing 2: The Game of Monopoly

```
2 CLEAR100:DEFINTA-Z:DIMB(40),T(40),P(40),M(40),N$(40),
C(40):H1=50:FORB=1TO40:READN$(B):M=N+1:IFH=10,H=0:H1=H1
+50:U$(5)="HOTEL":U$(0)="HOUSE":H3=1:U$(3)="SELL ":U$(4
)="PURCHASE ":U$(2)="YOU":U$(1)="I":K$="WHAT !":T$="PLA
YER ":T1$=T$+"PROPOSITIONS"
3 M(B)=H1:NEXT:B=1588:INPUT"HOW MANY ARE PLAYING";P0:PR
INT"WHAT ARE THEIR FIRST NAMES":R$="MMMMM..... ":R$(1
)="TRADE":R$(2)=R$(1)+"/MONEY":R$(3)=R$(1)+"/PROPERTY":
R$(4)=R$(3)+"/MONEY":R$(5)=U$(4):J$="  YES - 1  NO - 2"
:D$(2)="DRAFTED":D$(1)="CREDITED"
4 FORP=1TOP0:INPUTP$(P):NEXT:INPUT"ENTER A # BETWEEN 1
AND 100";RR:C(1)=60:C(3)=60:C(5)=200:C(6)=100:C(8)=100:
C(9)=120:C(11)=140:C(12)=150:C(13)=140:C(14)=160:C(15)=
200:C(16)=180:C(18)=180:C(19)=200:C(21)=220:C(23)=220:C
(24)=240
5 C(25)=280:C(26)=260:C(27)=270:C(28)=150:C(29)=280:C(3
1)=300:C(32)=300:C(34)=320:C(35)=200:C(37)=350:C(39)=40
0:P$(0)="BANK":P$(9)="COMPUTER":C$=" GET OUT OF JAIL ":
E$="LET ME SEE IF I HAVE THIS STRAIGHT ":Z$="HEY, SUPER
 ":GOTO75
6 PRINTTAB(10);"PRESS  E N T E R  TO CONTINUE";:INPUTD$
:CLS:IFIJ>3ANDJA>0,815ELSEIFDD>0PRINTTAB(12);"THE ROLL
WAS DOUBLES REMEMBER <";D1;",";D2;">":GOSUB65:GOTO15:EL
SE75
7 A$="":A$=INKEY$:A=VAL(A$):IFA=0ORA>A1,7ELSERETURN
10 A1=7:GOSUB7:Q=A:PX=B:P=0:IFQ=5,270ELSEIFQ=7,70ELSEIF
Q=3,580ELSEIFQ=6,995ELSEIFQ=4,15ELSEIFO=1PRINTT$:GOTO13

11 PRINTTAB(6);"THE BOTTOM LINE TO ME IS: 1 - A DEPOSIT
  2 - A DEBT":PRINT:PRINTTAB(4);
12 A1=2:GOSUB958:GOSUB65:GOTO75
13 A1=9:GOSUB7:P9=A:INPUT"GETS";B9:IFB9>39,PRINTK$:GOTO
13:ELSEIFP9=0,P9=0
14 Q5=B(B9):B(B9)=P9:PRINTP$(P9);" HAS PURCHASED ";N$(B
9):GOSUB65:GOSUB788:GOTO75
15 R=0:CLS:N=0:PRINTTAB(20);"I SHALL NOW ROLL THE DICE"
:RANDOM:RN=RND(RR):FORR=1TORN:D2=RND(6):RANDOM:D1=RND(6
):NEXT:D=D1+D2:PRINT@144,"THE ROLL IS";D1;",";D2;"- A T
OTAL OF";D:PRINT:IFD1=D2,DD=DD+1ELSEDD=0:IFQ=5,18ELSE6
16 PRINTTAB(15);"HEY,I ROLLED DOUBLES FOR THE";DD;"TIME
":IFDD=3,DD=0:IFQ=4PRINT"OK PARDNER, ";N$(38):GOTO6:ELS
EX=38:GOTO21
18 IFQ=4,6ELSEIFIJ>0,888ELSEX=D+X:IFX>40X=X-40:IFX<>30P
```

Program continues

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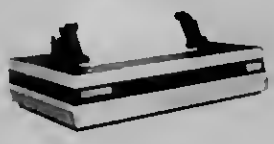

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```
RINTTAB(14);Z$;"I PASSED GO I COLLECT $200":B=B+200
20 PRINTTAB(10);:PRINT"WILL SOMEONE ADVANCE MY TOKEN TO
 ";N$(X)
21 IFX=30,X=10:IJ=4:D=0:DD=0:PRINT:PRINTTAB(19);"AH, PH
OOY !  MOVE ME TO JAIL":GOTO800:ELSEIFX<>20,25ELSEPRINT
TAB(20);Z$;N$(X):PRINT:PRINTTAB(24);"HOW MUCH DO I GET"
;:INPUTFP:PRINTTAB(20);:IFFP=0,PRINT"WOW, BUMMER"ELSEPR
INT"FANTASTIC"
24 B=B+FP:GOTO6
25 IFN$(X)=N$(7)ORN$(X)=N$(2)GOSUB950:GOTO6:ELSEIFX=4PR
INTTAB(21);"YUKY ! ";N$(X):GOTO850:ELSEIFX<>30,35ELSEPR
INTTAB(25);N$(X);" ????":R=75
32 IFB-R<=8,210ELSEB=B-R:PRINTTAB(9);" PLEASE PLACE $";
R;"IN THE KITTY FROM MY ACCOUNT":GOTO6
35 IFX=10ORX=40,6ELSEIFABS(B(X))=90RB(X)=90PRINTTAB(23)
;"HEAVY SIGH, I OWN THAT":GOTO6:ELSEIFABS(B(X))=80RB(X)
=60PRINTTAB(18);"SOME OF MY MORTAGED PROPERTY":GOTO6:EL
SEIFB(X)>9W7=B(X)/10ELSEW7=ABS(B(X))
45 IFB(X)<>0PRINTTAB(20);"OOPS ALREADY OWNED BY ";P$(W7
):PRINTTAB(12);"HOW MUCH RENT DO I OWE";:INPUTR:GOTO280

50 IFC(X)<B,B=B-C(X):PRINTTAB(10);"I'LL BUY IT - I'VE D
EDUCTED $";C(X);"FROM MY ACCOUNT":PRINTTAB(10);"PLEASE
GIVE ME THE DEED TO ";N$(X):B(X)=9:B9=X:P9=9:GOSUB700:G
OTO6
60 PRINT"RATS ! I ONLY HAVE $";B;" AND ";N$(X);" COSTS
$";C(K):GOTO6
65 FORT=1TO750:NEXTT:RETURN
70 CLS:PRINTTAB(12);"* * * * * * * * LEDGER * * * * * *
 * *";PRINT:PRINTTAB(11);"MY BANK ACCOUNT AT THIS MOMEN
T IS $";B:PRINTTAB(16);"I OWN THE FOLLOWING PROPERTY:":
FORN=1TO39:IFABS(B(N))=90ABS(N)=90PRINTTAB(22);N$(M)
71 NEXT:PRINTTAB(16);"I OWN";HS;U$(0);"(S) AND ";HT;U$(
5);"(S)":XT=X:IFXT=0,XT=40
72 PRINTTAB(10);"I AN CURRENTLY RESIDING AT ";N$(XT):GO
TO6
75 CLS:PRINT"* * * * * * *  C O M P U T E R - M O N O P
 O L Y  * * * * * * *";PRINT" ";STRING$(62,176):PRINTCH
R$(191);TAB(63);CHR$(191);CHR$(191);TAB(13);T$;"TRANSAC
TIONS ..... 1";TAB(63);CHR$(191);CHR$(191);T
AB(13);T$;"CHANCE/DEBT";
80 PRINT" ..... 2";TAB(63);CHR$(191);CHR$(1
91);TAB(13);T1$;" ..... 3";TAB(63);CHR$(191)
;CHR$(191);TAB(13);"DIE ROLL .....
. 4";TAB(63);CHR$(191);CHR$(191);TAB(13);"MY TURN .....
..... 5";
85 PRINTTAB(63);CHR$(191);CHR$(191);TAB(13);"POS/COR ..
..... 6";TAB(63);CHR$(191);CHR$(19
1);TAB(13);"LEDGER ..... 7";TAB
(63);CHR$(191);CHR$(191);TAB(63);CHR$(191);TAB(1);STRIN
G$(62,131):GOTO10
90 GP=C(Y3):GC=C(Y2)
100 L3=0:G=20:R=GC-GP:IFAX>Y(9),115ELSEIFY(9)>Y(Y1),G=3
0ELSE110
105 IFK>30+RND(G),L=16:GOTO120
110 L=10+RND(G):GOTO120
115 G=0:IFK>120+RND(20),L=20ELSEIFY(9)-Y(Y1),L=13ELSEL=
10:IFS<L,130ELSE150
120 IFS<L,140
130 IFP=1,612ELSEPRINTP$(Y1);" I'LL TRADE YOU ";H$(Y2);
PRINT"FOR ";N$(Y3);:IFL3=1,145ELSEIFL3=2,155ELSEPRINT:G
OTO165
140 L3=1:GOTO130
145 B1=K+C(Y2)+(C(Y3)*(1+RND(8))):PRINT" IF YOU WILL TH
ROW IN $";B1:GOTO165
150 L3=2:GOTO130
155 B1=C(Y3)+B*C(Y3)/B:IFB-B1>5*10PRINT" I'LL THROW IN
$";B1;" TO BOOT!"
160 L3=0:GOTO130
165 A1=2:PRINTJ$:GOSUB7:IFA=2,195
170 PRINTZ$;" !";:IFQ=3PRINT" I ACCEPT"ELSEPRINT
175 IFL3=2,PRINTP$(Y1);" COLLECT $";B1;" FROM MY ACCOUN
T":B=B-B1:IFCS=2PRINT" PLEASE TRAHSFER THE ";N$(Y3);" D
EED":GOTO188
180 IFL3=1,B=B+B1:PRINTP$(Y1);" DEPOSIT $";B1;"TO MY AC
COUNT"
185 PRINT" PLEASE EKCHAHGE TME LOTS":IFP=1,300ELSEB(Y2)
=Y1:B9=Y2:P9=Y1:GOSUB700
188 IFP>0,300ELSEB(Y3)=9:P9=9:B9=Y3:GOSUB700:IFCS=2,CS=
0
190 GOSUB65:IFPX>0,75
195 F=F-4:GOTO750
200 IFR<=B,B=B-R:PRINT"DRAW $";R;"FRON MY BANK ACCOUNT
- MY ACCOUNT IS NON $";B:GOTO6
210 B1=0:SX=0:PRINTTAB(14);R$;"I'M A BIT SHORT !":ZA=9:
FOROX=0TO1
215 FORM=39TO1STEP-1:IFB(M)<>ZAORSX>0ORP(M)>0,235ELSECM
=C(N)/2:B1=B1+CM:Q5=B(M):B(M)=0:P9=0:B9=N:GOSUB700
220 N=8:PRINTTAB(9);"I'VE MORTAGED ";N$(N);:IFSX>0RETUR
NELSEPRINT" FOR $";CM:IFB1>=RORR<B1+B*.85,B=B+B1:GOTO20
0
225 IFWK=1ORZA=90,296
235 IFZA=90,250ELSEHEXTM:ZA=-9:IFOX<2,NEXTDX:DX=2
240 FORM=1TO39:IFP(M)=0,260ELSEPM=P(M):IFPM=5,PM=1
245 B2=PM*M(M)/2:B1=B1+B2:IFP(N)=5,HT=HT-1ELSEHS=HS-P(M
)
250 T(M)=P(M):P(M)=0:SX=SX+1:GOSUB220:PRINT"'S ";:IFT(M
)=5,N=5
253 U=T(M):IPU=5,U=1
255 PRINTU;U$(N);"(S) FOR $";B2:GOTO260
258 IFB(M)=90,SX=SX+1
259 IF(M<37ANDM>3ANDSX=3)ORSX=2,EA=90:SX=0:GOTO215
260 IFB1>=RORR<B1+B*.95,B=B+B1:GOTO200
261 NEXTM:IFR<=B+B1,B=B+B1:GOTO200
263 IFZA<>90,ZA=90:GX=0:GOTO215
265 CLS:PRINT@470,"I ' M  B A N K R U P T":PRINT:GOTO6
270 H=8:PRINTTAB(23);"I'm THINKING .....!":FORN=39TO1ST
EP-1:CM=C(M)/2:IF(ABS(B(M))=80RB(M)=80)ANDB-CM>RND(200)
PRINT"I'm PAYING OFF THE MORTAGE ON ";N$(M);",$";CM:B9=
M:P9=9:B(M)=9:B=B-CM:H=1:GOSUB700
275 N=8:IFB(M)<>80ORB<111ORT(M)=8,290ELSEIFT(M)=5,P(M)=
5:HT=HT+1:N=5:T(M)=0:GOTO285
280 P(M)=P(M)+1:T(M)=T(M)-1:HS=HS+1
285 CM=M(M)/2:B=B-CM:PRINT"I'M REBUYING A ";U$(N);" AT
";N$(N);" FOR $";CM:H=1
290 NEXTM:IFH=1,INPUT"PRESS ENTER WHEN TRANSFERS CONCLU
DED";H
295 GOTO755
296 IFZA=9,290ELSEIFZA=90,ZA=-9ELSE2A=9
297 WX=1:GOTO215
298 NX=8:ZA=90:GOTO215
300 P=8:CS=8:IFA3=2,304
302 FORZ4=ZK+1TOZ6:B(Z(Z4))=9:P9=9:B9=Z(Z4):GOSUB700:NE
XT:IFPX=5,190
304 FORZ4=1TOZK:B(Z(Z4))=Y1:B9=Z(Z4):P9=Y1:GOSUB700:NEX
T:IFPX<3,190ELSEY5=Y1:IFI=2,Y5=9
307 FORZ4=1TOZ7:B(Z1(Z4))=Y5:B9=Z1(Z4):P9=Y5:GOSUB700:N
EXT:GOTO190
310 IFA3=2,350ELSEIFCP>0ANOB1<VX+GP*(1+E),675ELSEIFPL>0
ANDB1<GC*1+VX,675ELSE678
350 IFCP>1,670ELSEIFB1>GC*(3+RND(PL)),675ELSE670
425 XP=8:H4=8:N=8:CLS:PRINTTAB(7);"* * * * * * * * CON
STRUCTION TIME  * * * * * * * *";PRINT:FORN7=1TOY(9)+1:
FORH6=OTO1STEP-1:IFB(H5)=90ANDT(H6)=8,458
440 NEXTH6:O=39:NEXTH7:O=L1
442 IFH4=8,PRINTTAB(15);R$;"NOTHING HAPPENING HERE":GOS
UB865:GOTO15
445 INPUT"PRESS ENTER WHEN CONSTRUCTION COMPLETE";DS:IF
XP<>5,15ELSEKP=0:GOTO440
450 IFP(H6)=5ORB-M(H6)<=0,440ELSEB=B-M(H5)
454 IFP(H6)=4,HS=HS-4:P(H5)=5:N=5:HT=HT+1
456 PRINT"I'M BUILDING A ";U$(N);" AT ";N$(H6);" I'VE D
EDUCTED $";M(H6);"FROM MY ACCOUNT":L1=H6:IFP(H6)<4,HS=H
S+1:P(H6)=P(H6)+1
470 N=B:H4=H4+1:XP=XP+1:IFXP=5,445ELSE440
500 CLS:GV=0:B1=0:RANDOM:OK=0:P=1:PRINTTAB(16);" *  ";
T1$;"  *";PRINT:PRINTTAB(24);"WHO'S  THERE ?":PRINT:F
ORZ4=1TOP8:PRINTTAB(24);Z4;" - ";P$(Z4):NEXTZ4:PRINT:Z=
8
503 A1=P8:GOSUB7:Y1=A:CLS:PRINTTAB(10);"*  ";T1$
;"  *";Z7=8:PRINT:FORT=1TO5:PRINTTAB(20);T;"
";R$(T):NEXTT:Z6=0:ZK=0
510 A1=5:GOSUB7:PX=A:ONPXGOTO520,530,550,575,580
520 PRINT"TRADE :  FOR WHICH OF MY PROPERTIES IS YOUR O
FFER":GOTO523
521 PRINTK$:Z6=Z6-1
523 Z6=Z6+1:Z(Z6)=0:INPUT" LOT ID#";Z(Z6):IFZ(Z6)>39,52
1ELSEIFZ(Z6)<>0,523ELSEIFZK=0,ZK=Z6-1:PRINT"WHICH OF YO
UR PROPERTIES OO YOU OFFER IN TRADE":GOTO523
525 CLS:PRINT"YOU OFFER :":FORZ4=ZK+1TOZ6:PRINTTAB(20);
N$(Z(Z4));:NEXTZ4:PRINT:PRINT"FOR MY :":PRINT:FORZ4=1TOZ
K:PRINTTAB(20);N$(Z(Z4));W=ABS(B(Z(Z4))):IFW<>9ANDW<>90
,OK=1
526 NEXTZ4:PRINT:CP=CP/Z4:IFPX>2RETURNELSEGOSUB565:IFPX
=1,596
527 PRINT"AND ";U$(A3);" KICK IN $";B1;:GOTO596
530 PRINTR$(2)
531 PRINT:PRINT"ARE YOU REQUESTING PAYMENT - 1  OR  OFF
ERING PAYMENT - 2?"
533 A1=2:GOSUB7:A3=A:INPUT"HOW MUCH";B1:IFB1>9999,540EL
SEIFPX=2,528ELSEGV=GV+B1:RETURN
540 PRINTK$:GOTO533
550 CLS:PRINTR$(3)
553 PRINT"WHO PUTS UP THE EXTRA PROPERTY  ME - 1  OR  Y
OU - 2 ?"
555 A1=2:GOSUB7:A1=A:PRINT"I'M LISTENING":PRINT"WHICH A
RE THE PRIMARY PROPERTIES INVOLVED ?":PRINT"OF MY PROPE
RTY":GOSUB523:PRINT:PRINT" AND THE ADDITIONAL PROPERTY
?":PRINT:GOTO568
558 PRINTK$:Z7=Z-1
560 Y5=Y1:Z7=Z7+1:Z1(Z7)=0:INPUT" LOT ID#";Z1(Z7):IFZ1(
Z7)>39,550ELSEIFZ1(Z7)<>0,560ELSEZ7=Z7-1:FORZ4=1TOZ7:PR
INTN$(Z1(Z4));" ";:GV=GV+C(Z1(Z4)):I=A1:IFA1=1,Y5=9
561 W=ABS(B(Z1(Z4))):IFW=Y5ORW=Y5*10,OK=1
564 NEXTZ4:PRINT:IFPX=4RETURN
565 PRINTES;P$(Y1):PRINT"YOU WRNT ME TO TRADE YOU ";:FO
R24=1TOZK:PRINTH$(Z(Z4));" ,";:NEXTZ4:PRINT"FOR YOUR";:
FORZ4=ZK+1TOZ6-1:PRINTN$(Z(Z4));" ,";:NEXTZ4:IFPX<3RETU
RNELSEPRINT" AND ";U$(A1);" THRON IN ";
573 FORZ4=1TOZ7:PRINTN$(Z1(Z4));" , ";:NEXTZ4:IFPX=4RET
URNELSE596
575 PRINTR$(4):PRINT:GOSUB553:GOSUB531:GOSUB565:GOTO527

580 CLS:PRINTU$(4);"'S ";T1$:PRINT:PRINT"DO YOU PROPOSE
 TO  SALE - 1  OR  PURCHASE - 2":A1=2:GOSUB7:A3=A:IFA3
=1,594
585 PRINT"WHICH OF MY PROPERTY ARE YOU INTERESTED IN:":
GOTO593
590 PRINTK$:Z6=Z6-1
593 Z6=Z6+1:Z(Z6)=0:INPUT" LOT ID#";Z(Z6):IFZ(Z6)>39,59
8ELSEIFZ(Z6)<>0,593ELSEZ6=Z6-1:IFA3=1,RETURNELSEINPUT"A
ND HOW MUCH DO YOU OFFER TO PAY";B1:GOTO595
594 PRINT"WHAT DO YOU HAVE FOR SALE:":GOSUB593:INPUT"HO
W MUCB MONEY ARE YOU ASKING";B1
595 PRINTP$(Y1);ES;" -  YOU PROPOSE TO ";U$(2+A3);:FOR
E4=1TOZ6:PRINTN$(Z(Z4));",";:NEXTZ4:PRINT" FOR $";B1
596 PRINT"CORRECT?";J$:A1=2:GOSUB7:IFA=2,580
600 E=8:VX=RNO(55):CP=8:PL=8:GC=8:GP=8:IFOK=1,670ELSEIF
```

Program continues

```
PX<>5,680ELSEIFA3=1,ZX=0:GOTO686
683 FORZ5=1TOZK:IFB(Z(Z5))<>9,670ELSEB9=Z(Z5):GOSUB780:
GC=GC+C(B9):IFB(X2)=-Y1ORB(Z)=-Y1,PL=2ELSEIFB(X2)=Y1ORB
(Z)=Y1ORB(Y)=YI,PL=1
684 NEXT:IFZK>1,GC=GC/ZK
685 IFPX=5,610
686 FORZ9=ZK+1TOZ6:B9=Z(Z9):IFB(B9)=9B,670ELSEGOSUB780:
GP=GP+C(B9):E=E+1:IFB(X2)=-9ORB(Y)=-9ORB(Z)=-9,CP=2ELSE
IFB(X2)=9ORB(Z)=9ORB(Y)=9,CP=1
688 NEXT:IFZ6-E>1,GP=GP/(Z6-E)
610 Y2=Z[ZK):Y3=Z(ZK+1):GOTO188
612 IFPX=5,310
615 IFCP=1ANDPL=2,670ELSEIFPX>1,620ELSEIFL3=2ORL=10RS>
L,675ELSE670
620 IFPX>2,620ELSEIFA3=1,625ELSEIFL3<>2ANDBI>50+RND(50)
,675
623 IFB1>PL*GC+VX,675ELSE670
625 IFB<B1ORBI>B*((CP*10+VX)/100),670ELSE675
626 IFPX>3ANDA3=2ANDBI>GV*.4,670
630 FORZ4=1TOZ7:N=Z1(Z4):IFW=-9ORW=90,670ELSEIFA1=1,B9=
W:GOSUB780:IFABS(B(X2))=Y1ORABS(B(Z))=Y1ORABS(B(Y))=Y1,
670
632 NEXTZ4
635 IFA1=2,645ELSES3=10:IFL3=2,S3=0
640 IFCP=2ANDS>S3ANDGV<400,675ELSE670
645 IFCP<PL,670ELSEIFL3=0,S4=200ELSEIFL3=1,S4=400ELSES4
=0
648 IFGV>S4,675ELSE670
670 PRINT:PRINT"WITH REGRET I MUST REFUSE YOUR OFFER";:
IFOK=1PRINT"  TURKEY!"
671 GOSUB65:GOTO75
675 IFPX=10RPX=3,L3=0:GOTO685
680 L3=3-A3:IFPX=5,CS=L3
685 GOTO170
700 ONB9GOTO 703,750,703,750,750,705,750,705,705,750,71
0,750,710,710,750,715,750,715,715,750,720,750,720,720,7
50,725,725,750,725,750,730,730,750,730,750,750,733,750,
733
703 V=1:X2=1:Y=3:Z=B9:GOTO735
705 X2=6:Y=8:Z=9:GOTO735
710 X2=11:Y=13:Z=14:GOTO735
715 X2=16:Y=18:Z=19:GOTO735
720 X2=21:Y=23:Z=24:GOTO735
725 X2=26:Y=27:Z=29:GOTO735
730 X2=31:Y=32:Z=34:GOTO735
733 V=1:X2=37:Y=39:Z=B9
735 IFP=1RETURNELSEIFVV=2,775ELSEIFVV=1,760ELSEQ8=ABS(P
9)=ABS(B(Y)):Q7=ABS(P9)=ABS(B(Z)):Q6=ABS(P9)=ABS(B(X2))
:Q9=Q8+Q7+Q6:Q4=Q9:IFQ9=-3,Q9=1ELSEIFQ9=-1,Q9=1ELSEIFQ
9=-2,Q9=-1
736 IFQ5<10RQ4=-3,739ELSEIFB(B9)=B(Y)/10RB(B9)=B(Z)/1
0,752ELSEY(P9)=Y(P9)-1:IFB9<>X2,B(X2)=B(X2)/-10
737 IFB9<>Y,B(Y)=B(Y)/-10
738 IFB9<>Z,B(Z)=B(Z)/-10
739 B(B9)=B(B9)*Q9:IFV=1,V=0:IFB(B9)>9,741ELSEIFABS(B(X
2))<>ABS(B(Y)),750
741 IFQ8=0,745ELSEIFQ8=Q7,B(Y)=B(B9):B(Z)=B(B9):IFQ6<>Q
7ANDB(X2)=<0,B(X2)=B(X2)*-1
742 IFQ8=Q6,B(Y)=B(B9):B(X2)=B(B9):IFQ7<>Q6ANDB(Z)<0,B(
Z)=B(Z)*-1
745 IFQ7<>0ANDQ7=Q6,B(Z)=B(B9):B(X2)=B(B9):IFQ8<>Q6ANDB
(Y)<0B(Y)=B(Y)*-1
749 IFQ9=10,Y(P9)=Y(P9)+1
750 S=S+1:RETURN
752 B(B9)=B(B9)*10:RETURN
755 FORF=39TOISTEP-1:IFB(F)=-9,VV=1:B9=F:GOTO780
758 IFF<0,F=0
759 NEXTF:IFY(9)>0ANDB>RND(150)+210,425ELSE15
760 VV=0:IFB(X2)>0ANDB(X2)<0 Y1=B(X2):Y3=X2:GOTO770
763 IFB(Y)>0ANDB(Y)<0 Y1=B(Y):Y3=Y:GOTO770
765 IFB(Z)>0ANDB(Z)<0 Y1=B(Z):Y3=Z:GOTO770
766 IFF>4ANDF<36,758ELSEIFB(X2)<0ANDB(X2)<>-9,Y1=ABS(B(
X2)):Y3=X2:GOTO769
767 IFB(Y)<0ANDB(Y)<>-9,Y1=ABS(B(Y)):Y3=Y:GOTO769:ELSE7
58
769 IFF<4,771
770 FORX3=39TOISTEP-1:IFB(X3)<>-Y1 NEXTX3ELSEVV=2:B9=X3
:GOTO780
771 B1=C(Y3)+(B*C(Y3)/8):IFB-B1<0,195ELSEPRINTPS(Y1);"
I'LL GIVE YOU $";B1;" FOR ";N$(Y3):L3=2:CS=2:GOTO165
775 VV=0:IFB(X2)=9 Y2=X2:GOTO780
776 IFB(Y)=9 Y2=Y:GOTO780
777 IFB(Z)=9 Y2=Z:GOTO780
778 NEXTX3:GOTO771
780 FORZK=1TOP0:IFY(ZK)>0,AX=1
783 NEXTZK:GOTO990
800 IFJA>0,815ELSEIFDD>8ANDDD<3,IJ=0:GOTO810
802 IFS<16ANDB-50>50,PRINT" NO FUTURE IN HERE ";:GOTO80
4
803 IJ=IJ-1:IFIJ<>0,805ELSE PRINT"THAT'S ALL FOLKS - ";
804 PRINT"I'VE GOT TO";C$;" ";:R=50:DD=0:IJ=0:GOTO32
805 IFIJ<3,PRINTTAB(17);"I ONLY HAVE";IJ;"MORE TIMES IN
 JAIL"
807 GOTO6
810 PRINTTAB(16);Z$;
812 PRINT"SET ME ON ";N$(10):DD=0:IJ=0:GOTO6
815 JA=JA-1:PRINT"PLACE MY";C$;"FREE CARD IN THE DECK &
 ";:GOTO812
850 R=0:FORX1=1TO39:IFB(X1)=90RB(X1)=ABS(9),R=R+C(X1):
IFP(X1)=0,855ELSEIFP(X1)=5,J=N(X1)ELSEJ=P(X1)*N(X1)
854 R=R+J
855 NEXT:R=(R+8)*.1:IFR>200,R=200
860 PRINT"I HAVE COMPUTED MY TAXES TO BE  $";R;:GOTO32
950 PRINTTAB(0);"AND DRAW THE TOP CARD FROM THE ";N$(X)
;" STACK":PRINTTAB(8);"THEN BASED UPON THE CONTENTS OF
TNE CARD PERFORM ONE":PRINTTAB(17);"OF THE FOLLOWING OP
ERATIONS FOR ME":PRINT
955 PRINTTAB(10);"AN ACCOUNT DEPOSIT ..... 1":PRI
NTTAB(18);"AN ACCOUNT DEDUCTION..... 2":PRINTTAB(1
8);"STREET ASSESSMENT ..... 3":PRINTTAB(18);"A";
C$;"FREE CARD .. 4":PRINTTAB(18);"A BOARD ADVANCEMENT .
..... 5"
956 PRINTTAB(10);"GO BACK 3-SPACE ..... 6":A1=
6
958 GOSUB7:PRINTTAB(6);:ONAGOTO993,990,960,994,995,998
960 PRINT"* * * * * * * STREET ASSESSMENT/REPAIRS * * *
 * * * *":H1=40:H2=115:IFN$(X)=N$(7) H1=25:H2=100
965 R=(HS*H1)+(HT*H2):IFR=0,PRINTTAB(27);"AM I LUCKY":G
OTO6
970 PRINT"GOOD GRIEF! I'VE GOT TO PAY $";R;:GOTO32
990 PRINT"* * * * * * * * * * * DEDUCTION  * * * * * *
 * * * * *":GOSUB992:IFB-R<0,210ELSEB=B-R
991 PRINT"MY ACCOUNT HAS BEEN DULY ";D$(A);" AND NOW TO
TALS $";B:RETURN
992 PRINT:INPUT"ENTER THE AMOUNT PLEASE";R:RETURN
993 PRINT"* * * * * * * * * * * * * DEPOSIT  * * * * * *
 * * * * * *":GOSUB992:B=R+B:GOTO991
994 JA=JA+1:PRINTTAB(14);"* * * * *";C$;"FREE * * * * *
";:PRINTTAB(23);"I CAN ALWAYS USE THAT":RETURN
995 D=0:PRINT"* * * * * * * * * BOARD ADVANCEMENT  * *
 * * * * * *";:PRINT:PRINTTAB(16);:INPUT"WHAT'S THE ID
# OF MY DESTINATION";AB:IFAB<X,D=40
996 X=AB:IFQ=6,75ELSE18
998 X=X-3:IFX=-1,X=39
999 GOTO28
1000 DATANEDITERRANEAN AVENUE,COMMUNITY CHEST,BALTIC AV
ENUE,INCOME TAX,READING R & R,ORIENTAL AVENUE,CHANCE,VE
RMONT AVENUE,CONNECTICUT AVENUE,JUST VISITING
1010 DATAST. CHARLES PLACE,ELECTRIC COMPANY,STATES AVEN
UE,VIRGINIA AVENUE,PENNSYLVANIA R & R,ST. JAMES PLACE,C
OMMUNITY CHEST,TENNESSEE AVENUE,NEW YORK AVENUE,FREE PA
RKING
1020 DATAKENTUCKY AVENUE,CHANCE,INDIANA AVENUE,ILLINOIS
 AVENUE,B & O RAILROAD,ATLANTIC AVENUE,VENTNOR AVENUE,N
ATER NORXS,MARVIN GARDENS,GO TO JAIL
1030 DATAPACIFIC AVENUE,NORTH CAROLINA AVENUE,COMMUNITY
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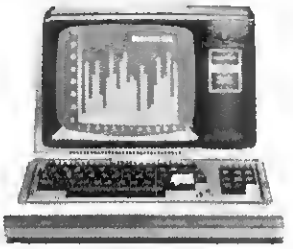

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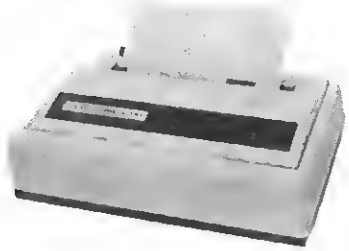

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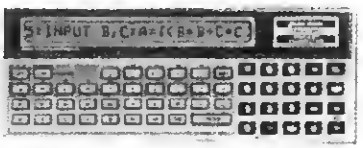

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Being a photography teacher as well as a computerist, it seemed natural that I combine the two interests. The first and most obvious photographic use for the personal computer is an electronic collecting place for photographic data.

Photographers are deluged with masses of technical information that is supposed to assist them in making better photographs: camera types, film speeds, filters, exposure variables, chemicals, time and temperature calculations, paper grades, and long lists of photographic accessories.

Why not put it all in one easily accessible place?

A second promising blend of photography and the microcomputer is its educational application. The personal computer can simulate several photographic processes such as f/stop openings and shutter speed action. It can quickly calculate exposure setting changes, proportions for chemical mixing, and time-temperature relationships. And it can actually do all your timing for you, so that a budding photographer can concentrate on making good photographs.

In the future, easy to use add-ons will be available to the photographer. With the proper circuitry you will be able to interface devices that measure light, moisture and temperature. Already the computer can be used to time the enlarger. It can set and trip critical shutter speeds. It can coordinate multiple lighting set-ups and multiple camera arrangements.

Photographic Notebook

The application I chose here is film development, because it allows the TRS-80 to show off several of its advantages. The program that follows is designed to be part of a series of photographic programs that can be combined into a photographic notebook.

When designing the program, I wanted it to be easy enough for the beginner to use, yet be valuable to a more experienced photographer. It had to run smoothly so that, while using it, you assume the role of a photographer—not a computer programmer. Finally, I wanted a flashy program to satisfy my creative instincts.

Film development uses a highly interactive style to lead you through nine steps toward printing of a variety of black-and-white film types. You simply select the film and developer you are using, and let the computer handle all the timing cycles.

The program assumes that you are using a temperature of 68 degrees Fahrenheit. However, you can alter the development time in case you are using a different temperature or you are compensating for under or over exposure.

All input is followed by a reassuring beep and the completion of each timing cycle is signaled with an audio alarm. To make use of these sound features, connect the cable coming from the keyboard (this normally plugs into the aux input of the cassette recorders) into an amplifier. You can leave both the recorder and the amplifier connected by using a Y-adapter.

The sound routine, which is Dennis Kitsz's Babybeep (April, *80 Microcomputing*) is found in lines 200 through 400.

All single stroke input uses the INKEY$ feature of Level II. Multiple key input is used only at noncritical times and, of course, requires the use of the enter key.

In lines 500-599 the computer allows you the option of fine-tuning the timer. This routine is for the benefit of non-programmers. Normally you will be able to answer N, and let the timer work in its preset condition. The loop value is set as 30090 in line 30.

However, if your TRS-80 clock is found to operate at a slightly different rate, or if you have modified any part of the program that effects the timing loop, you have two options: Firstly, assign a different value to TZ in line 30. Secondly, simply answer Y when running the fine tune routine and follow its instructions.

Assume Familiarity

The program assumes some familiarity with developing black and white film. However, it is careful to guide beginners systematically.

You select your film and developer from a model defined by the program in lines 600

Above: Title employs a graphic device while data is read.

Top: Menu of Developers. Bottom: Mixing instructions for Developer. Left: Rinsing time is shown using the clock routine.

Left: Each step pauses until you want the timer to begin. Above: Each step is user-interactive.

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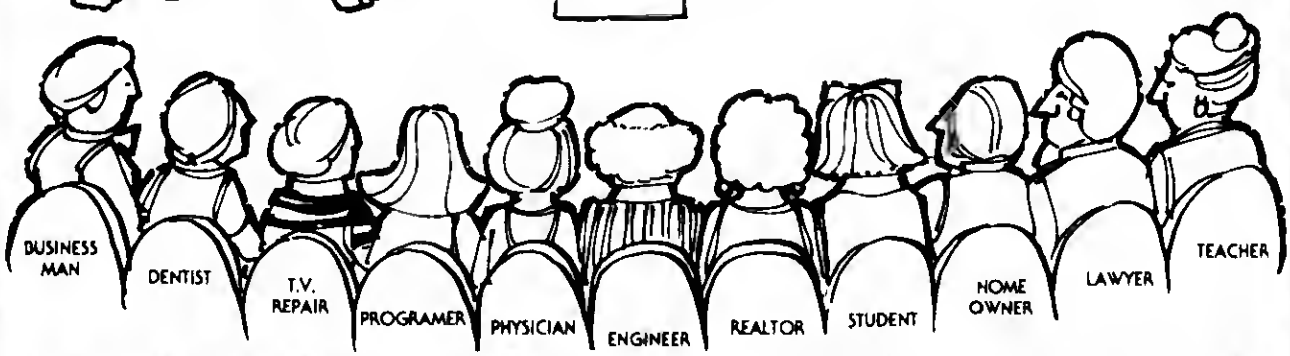

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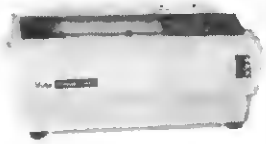

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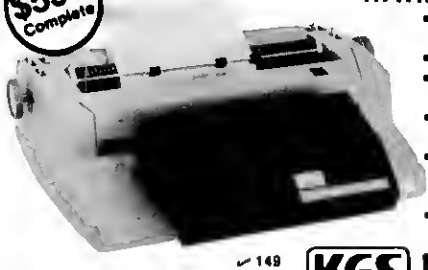

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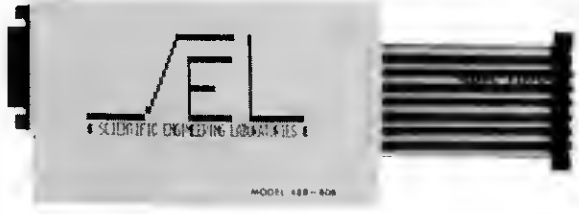

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and 800 respectively. If your favorite film or developer is not used, it is easy to make an addition or change. If you do make changes, be sure to alter the developing times. These are found as data in line 1200 and within a video chart beginning at line 1500.

At line 2000 the program introduces the nine steps it will use to develop your black and white film. In addition to develop, stop and fix, the program includes other processing steps that are useful. For example, a step is devoted to hypo-clearing to speed up the washing time. The final list reads:

1. Load
2. Develop
3. Stop
4. Fix
5. Rinse (this is a pre-wash step, using water)
6. Hypo Clearing
7. Wash
8. Wetting Agent
9. Dry

This list should be complete enough to satisfy most darkroom workers.

When running the program, you are given the chance to review these nine steps. The review also covers a short explanation of what each step does. If you are familiar with the developing process, you can bypass this review by answering N (line 2020).

Several of the imbedded routines may be useful for those wishing to create their own film developing program. Developer Mixing (line 2500) and a subroutine that calculates chemical ratios (line 3100) contain the annoying mathematics that must always be computed before chemicals can be added to your developing tank.

It's easy to extract the routines for Develop, Stop, Fix, Wash and Dry. They are listed with associated timings in lines 2600-3000. If you do not use a hypo-clearing agent, or wish to make other modifications to the program's chemistry, this is the area of the program to review. All of these steps use the Clock routine found in line 3300 and the Alarm routine found in line 3600.

The decimal equivalents for Dennis

A$	Press ENTER	
D$	Developer Type	
F$	Film Type	
I$	Interrupt Timer	
R$	Review Steps	
G$,H$	Film Graphics	
X	Timing Loops	
I	Timing Loops	
D	Developer Choice	
F	Film Choice	
M	Minutes	
S	Seconds	
SS	Stock Solution	
SW	Water Solution	
ST	Total Working Solution	
ZQ	Timer Check (ZO = 3.149)	Line 3425
TZ	Timing Loop Increment Delay	Line 30090

Table 1. Line Numbering for Film Development

Kitsz's machine routine are found in the dete lines 200-400. Prior to the use of a particular sound, e value is POKEd into 16526, end Bebybeep is celled usIng X = USR(0).

Program Graphics

Notice that the cover (line 100) is supposed to repreeent e picture of a strip of 35mm tiim. The blenk film magically develops into the title, Film Development. All this is intended to dazzle your eyes and leeve you entertained, while the DATA statements (line 200 on) ere reed. I find this approech superior to a messege such es "Please wait" or "I'm working."

The second use of graphics also represents a strip of film. The subroutine in lines 3800-3870 also uses a graphic strip of film designed as a screen prompt. A value is assigned to the Y-axis, corresponding to a horizontal line position. This value in conjunction with the X values 0-127 is used in the Horizontal Line subroutines to SET the line.

10	Title
100	Cover
200	Babybeep
500	Timer Fine Tune
600	Select Film
800	Select Developer
1000	Film Developer Times
2000	The Nine Steps
2300	Load the Film
2500	Developer Mixing
2600	Develop
2700	Stop and Fix
2800	Wash and Dry
3000	Two-second Delay
3100	Mixing Chemicals
3300	Clock Routine
3800	Alarm
3800	Horizontal Lines (moving film strip)
3850	Solid Line
3870	Brokan Line
3900	Error Message

Table 2. Film Development Variables

SET and RESET are preferable here over other more rapid graphics, such as PRINT@ STRING, precisely because they are slower. The activity of e moving line is more eye-catching than en instant line.

At the very end of the listing is a short Error subroutine (line 3900). This is called in the case of an illegal input. This subroutine prints e polite "You have done wrong" message, and then, once again, returns you to the original input request.

There you have it. The program is somewhat long at 11K, but it contains many useful routines that can be used in other programs. A cassette version is available from myself. The program should be easy to follow by referring to Tables 1 and 2 and the REM statements. Also the line numbering should make it easier to seperate each routine. ■

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```
20
      CLEAR 200: POKE 16553,255
30 DEFINT T: TZ=30090
100 REM                    COVER

110 G$=CHR$(183)+CHR$(107
    )+CHR$(191): H$=STRING$(95,CHR$(191))
120 CLS: PRINT CHR$(23): PRINT@66,"**  PHOTOGRAPHY NOTE
    BOOK  **";
130 PRINT:PRINT:PRINT: FORI=0TO10: PRINT G$;: NEXT: PRI
    NT H$;: FORI=0TO10: PRINT G$;: NEXT: PRINT@576,"
    "
140 FOR X=24 TO 100: FOR Y=16 TO 22: RESET(X,Y): NEXT:N
    EXT
150 PRINT@400,"FILM DEVELOPMENT";
160 PRINT@704,"THIS PROGRAM WILL TAKE YOU STEP BY STEP
    THROUGH THE DEVELOPMENT OF YOUR FILM."
200 REM
                    BABYBEEP ROUTINE

          BY DENNIS BATHORY KITSZ

210 FORX=32000TO32303
    :READA:POKEX,A:NEXTX:POKE16527,125
220 DATA14,0,6,192,205,27,126,197,16,254,193,16,247,13,
    121,254
230 DATA0,32,239,201,14,16,33,32,0,205,27,126,6,160,16,
    254
240 DATA43,124,181,32,244,33,0,10,43,124,181,32,251,13,
    121,254
250 DATA0,32,227,201,14,10,6,48,205,27,126,197,6,255,16
    ,254
260 DATA193,16,245,6,80,205,27,126,197,6,96,16,254,193,
    16,245
270 DATA13,121,254,0,32,224,201,6,64,205,27,126,197,6,1
    92,16
200 DATA254,193,16,245,6,120,205,27,126,197,6,80,16,254
    ,193,16
290 DATA245,6,255,205,27,126,197,6,40,16,254,193,16,245
    ,6,176
300 DATA205,27,126,197,6,176,16,254,193,16,245,6,255,20
    5,27,126
310 DATA197,6,32,16,254,193,16,245,14,16,6,16,205,27,12
    6,197
320 DATA6,255,16,254,193,16,245,13,121,254,0,40,10,33,0
    ,10
330 DATA43,124,181,32,251,24,227,201,14,8,6,0,205,27,12
    6,197
340 DATA4,120,246,0,32,250,193,4,120,246,0,32,239,6,255
    ,205
350 DATA27,126,197,16,254,193,16,247,13,121,254,0,32,22
    0,201,6
360 DATA120,205,27,126,197,6,128,16,254,193,16,245,201,
    6,192,205
370 DATA27,126,197,6,64,16,254,193,16,245,201,14,32,33,
    10,0
380 DATA205,27,126,6,255,16,254,43,124,181,32,244,33,0,
    1,43
390 DATA124,181,32,251,13,121,254,0,32,227,201,62,2,211
    ,255,62
400 DATA0,211,255,201,60,69,78,70,73,03,32,75,73,04,83,
    90

410 POKE 16526,237:    REM  "BLEEP"
420 Y=46: GOSUB 3000: PRINT@964,"PRESS THE  "CHR$(34)"E
    NTER-KEY"CHR$(34);: INPUT A$: CLS: X=USR(0)
500 REM
                * TIMER FINE TUNE *
510 CLS: PRINT CHR$(23): PRINT@120,"THE COMPUTER TIM
```

program continues

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PERCOM	YES	25ms	YES	NO	250K bytes (both sides)	YES	NO
MPI	NO	5ms	YES	YES	125K bytes	YES	NO
SHUGART	NO	40ms	YES	NO	109K bytes	NO	NO
SIEMENS	NO	25ms	YES	NO	125K bytes	YES	NO
TANDON	NO	5ms	NO	NO	125K bytes	NO	NO
PERTEC	YES	25ms	YES	NO	250K bytes (both sides)	NO	NO
BASF	NO	12ms	YES	NO	125K bytes	NO	NO

Factual material from current manufacturer's data sheets is believed reliable but cannot be guaranteed comparing Aerocomp Model 40-1 to similar models

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```
    ER IS PRE-SET.": GOSUB 3000
515 PRINT@320,"HOWEVER, YOU MAY DESIRE TO": PRINT"FINE-
    TUNE THE COMPUTER BY": PRINT"SYNCHRONIZING IT WITH
     A CLOCK": PRINT"OF KNOWN ACCURACY.": GOSUB 3000:
    GOSUB 3000
520 Y=37: GOSUB 3000: PRINT@768,"DO YOU WISH TO  FINE-T
    UNE  THE  TIMER (Y/N) ?"
525 Y$=INKEY$: IF Y$="" GOTO 525
527 IFY$="Y"GOTO535
530 IF Y$="N" GOTO 600
532 GOTO520
535 CLS: X=USR(0): PRINT@15,"**  THIS IS HOW WE WILL DO
     IT  **": Y=4: GOSUB 3050
537 PRINT@128,"WE WILL GO THROUGH THE SIMULATION OF A 1
    -MINUTE TIMING CYCLE,  COMPLETE WITH THE  "CHR$(3
    4)"AGITATE TANK"CHR$(34)"  MESSAGE."
540 PRINT"   (1)  WHEN THE   "CHR$(34)"TIMER-SYNCHRONIZ
    ATION TEST"CHR$(34)"  APPEARS ON THESCREEN, PRESS
     THE "CHR$(34)"ENTER-KEY"CHR$(34)" AT THE SAME TIN
    E YOUR CLOCK BEGINSITS 1-MINUTE CYCLE."
542 PRINT"   (2)  WHEN YOUR CLOCK COMPLETES ITS 1-MINUT
    E CYCLE, PRESS THE "CHR$(34)"SPACE-BAR"CHR$(34)"."
    : PRINT
545 PRINT"THIS SEQUENCE RUNS THE COMPUTER TIMER FOR WHA
    T IT THINKS IS 1  MINUTE.  THE COMPUTER WILL TELL
     YOU HOW FAR OFF IT IS COMPARED  TO YOUR WATCH, AN
    D MAKE THE NECESSARY ADJUSTMENTS."
548 PRINT:PRINT"PRESS THE  "CHR$(34)"ENTER-KEY"CHR$(34)
    " FOR THE  "CHR$(34)"TIMER-SYNCHRONIZATION TEST"CH
    R$(34);: INPUT A$
550 M=1: ZQ=3.149: CLS: X=USR(0): PRINT@138,"------  TI
    MER SYNCHRONIZATION TEST  ------": GOTO 3300
560 CLS: PRINT CHR$(23)
562 IF S=0 PRINT@200,"-==  E X A C T  ==-": GOTO 505
564 IF M=0 SA=-S: PRINT@128,"THE COMPUTER TIMER IS";S;"
    SECONDS              SLOW": GOTO 570
566 IF M<0 SA=60-S: PRINT@128,"THE COMPUTER TIMER IS";S
    A;"SECONDS              FAST"
570 TZ=TZ+(90*SA/60)
580 FOR Y=22 TO 24: GOSUB 3070: NEXT:  PRINT@448,"*****
    *  THE COMPUTER HAS  ******      ADJUSTED ITS TIME
    R          "
585 PRINT@772,"WOULD YOU LIKE TO TEST THE         TIMER
     AGAIN (Y/N) ?"
590 T$=INKEY$: IF T$="" GOTO 590
593 IF T$="Y" GOTO 550
594 IF T$="N" GOTO 600
599 GOSUB 3000
600 REM
                * SELECT FILM *

610 ZQ=0: POKE
     16526,237: CLS: X=USR(0): PRINT CHR$(23)
620 PRINT:PRINT"SELECT THE FILM YOU ARE USING:"
630 Y=10: GOSUB 3000
640 PRINT: PRINT:PRINT:PRINT"1.  VERICHROME PAN": PRINT
     "2.  PLUS-X": PRINT"3.  TRI-X"
650 Y=40: GOSUB 3000
660 PRINT@850,"(BY NUMBER)"
670 F$=INKEY$: IF F$="" GOTO 670  ELSE F=VAL(F$)
675 IF F>3 OR F<1 GOSUB 3900: GOTO 600
680 CLS: X=USR(0)
690 IF F=1 THEN F$="VERICHROME"
700 IF F=2 THEN F$="PLUS-X"
710 IF F=3 THEN F$="TRI-X"
800 REM
                * SELECT DEVELOPER *

810 CLS:
     PRINT CHR$(23):  PRINT@00,"OK ... ";F$: POKE 16526
```

program continues

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```
     ,237
820 PRINT@262,"NOW SELECT THE DEVELOPER:":PRINT:PRINT
830 Y=16: GOSUB 3800
840 PRINT"1. D-76","5. HC-110 (A)
850 PRINT"2. D-76 (1:1)","6. HC-110 (B)"
860 PRINT"3. MICRODOL-X","7. DK-50 (1:1)"
870 PRINT"4. POLYDOL"
880 Y=40: GOSUB 3800
890 PRINT@850,"(BY NUMBER)"
900 D$=INKEY$: IF D$="" GOTO 900  ELSE D=VAL(D$)
905 IF D>7 OR D<1 GOSUB 3900: GOTO 800
910 CLS: X=USR(0)
920 IF D=1 THEN D$="D-76"
930 IF D=2 THEN D$="D-76 (1:1)"
940 IF D=3 THEN D$="MICRODOL-X"
950 IF D=4 THEN D$="POLYDOL"
960 IF D=5 THEN D$="HC-110 (A)"
970 IF D=6 THEN D$="HC-110 (B)"
980 IF D=7 THEN D$="DK-50"
1000 REM
                * FILM DEVELOPMENT TIMES *

10   10 PRINT CHR$(23): PRINT@320,"WOULD YOU LIKE TO SE
     E A COMPLETE  CHART OF DEVELOPING TIMES ?": PRINT@
     468,"( Y/N )"
1020 A$=INKEY$: IF A$="" GOTO 1020
1030 CLS: X=USR(0)
1040 IF A$="Y" GOTO 1500
1050 PRINT CHR$(23): PRINT@128,"AT 68 DEGREES FAHRENHEI
     T (20 C)": PRINT"USING ";D$;" DEVELOPER": PRINT"WI
     TH ";F$;" FILM"
1070 DIM T(7,3)
1200 DATA 7,6,8,9,8,11,9,8,11,10,6,8,3.75,8,3.75,8,5,5,
     5,4,6
1210 FOR DD=1 TO 7: FOR FF=1 TO 3: READ T(DD,FF): NEXT:
      NEXT
1215 IF T(D,F)=0 PRINT@512,"   ---  NOT  RECOMMENDED  -
     --": GOSUB 3000: GOTO 600
1220 PRINT@384,"DEVELOPING TIME IS: ";T(D,F);" MIN": M=
     T(D,F)
1230 Y=22: GOSUB 3850: Y=34: GOSUB 3800
1240 PRINT@704,"WOULD YOU LIKE TO ADJUST": PRINT@768,"T
     HE DEVELOPING TIME ( Y/N ) ?"
1250 A$=INKEY$: IF A$="" GOTO 1250
1260 CLS: X=USR(0)
1270 IF A$="N" GOTO 2000
1500 REM        DEVELOPING TIME CHART

1510 CLS: PRINT@6
     6,"FILM DEVELOPMENT TIMES FOR 68 DEGREES FAHRENHEI
     T:": PRINT
1520 PRINT"DEVELOPER","VERICHROME","PLUS-X","TRI-X"
1530 PRINT STRING$(58,CHR$(45))
1540 PRINT"D-76",7,6,8
1550 PRINT"D-76 (1:1)",9,8,11
1560 PRINT"MICRODOL-X",9,8,11
1570 PRINT"POLYDOL",10,6,8
1580 PRINT"HC-110 (A)",3.75,"NOT RECMND",3.75
1590 PRINT"HC-110 (B)",8,5,5
1600 PRINT"DK-50 (1:1)",5,4,6
1610 Y=40: GOSUB 3800
1620 PRINT:PRINT"RECOMMENDED TIMES FOR GIVEN FILM/DEVEL
     OPER COMBINATIONS.": INPUT"SELECT FROM THE ABOVE O
     R ENTER YOUR ADJUSTED TIME";M
1630 X=USR(0)
2000 REM
                * THE 9 STEPS *

2010 CLS: PRI
     NT CHR$(23): PRINT@326,"WOULD YOU LIKE TO REVIEW"
```

program continues

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(T) **ACCOUNTS PAYABLE** — Tracks current and aged payables and incorporates a check writing feature. Maintains a complete vendor file with information on purchase orders and discount terms as well as active account status. Produces reports as follows: Open Voucher Report, Accounts Payable Aging Report and Cash Requirements. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC .... [illegible]

(T) **ACCOUNTS RECEIVABLE** — Generates invoice register and complete monthly statements. Tracks current and aged receivables. Maintains customer file including credit information and account status. The current status of any customer account is instantly available. Produces reports as follows: Aged Accounts Receivable, Invoice Register, Payment and Adjustment Register and Customer Account Status Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC .... [illegible]

(T) **PAYROLL** — Prepares payroll for hourly, salaried and commissioned employees. Generates monthly, quarterly and annual returns. Prepares employee W-2's. Includes tables for federal withholding and FICA as well as withholding for all 50 states plus up to 30 cities from pre-computed or user generated tables. Will print checks, Payroll Register, Monthly Summary and Unemployment Tax Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC .... [illegible]

(T) **INVENTORY** — Maintains detailed information on each inventory item including part number, description, unit of measure, vendor and reorder data, item activity and complete information on current item costs, pricing and sales. Produces reports as follows: Physical Inventory Worksheet, Inventory Price List, Departmental Summary Report, Inventory Status Report, The Reorder Report and the Period-to-Date and Year-to-Date reports. Supplied in source code for Microsoft BASIC .... $1,100/$30

(T) **MAILING ADDRESS** — Keeps track of name and address information and allows the selective printing of this information in the form of mailing lists or address labels. Allows the user to tailor the system to his own particular requirements. User-defined format and print-out system uses a special format file which tells programs how to print the mailing list or address labels. Standard format files are included with system. Automatic sorting of data uses indexed file management routines which allow the name and address information to be sequentially retrieved and printed without file sorting. Supplied in source code for Microsoft BASIC .... $700/$30

GRAHAM-DORIAN SOFTWARE SYSTEMS

(T) **GENERAL LEDGER** — An on-line system; no batching is required. Entries to other GRAHAM-DORIAN accounting packages are automatically posted. User establishes customized C.O.A. Provides transaction register, record of journal entries, trial balances and monthly closings. Keeps 13 month history and provides comparison of current year with previous year. Requires CBASIC-2. Supplied in source .... $995/$35

(T) **ACCOUNTS PAYABLE** — Maintains vendor list and check register. Performs cash flow analysis. Flexible — writes checks to specific vendor for certain invoices or can make partial payments. Automatically posts to GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source .... $995/$35

(T) **ACCOUNTS RECEIVABLE** — Creates trial balance reports, prepares statements, ages accounts and records invoices. Provides complete information describing customer payment activity. Receipts can be posted to different ledger accounts. Entries automatically update GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source .... $995/$35

(T) **PAYROLL SYSTEM** — Maintains employee master file. Computes payroll withholding for FICA, Federal and State taxes. Prints payroll register, checks, quarterly reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC-2. Supplied in source .... [illegible]

(T) **INVENTORY SYSTEM** — Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source .... [illegible]

(T) **JOB COSTING** — Designed for general contractors. To be used interactively with other GRAHAM-DORIAN accounting packages for tracking and analysing expenses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source $995/$35

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(M) **MACRO-80** — 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included .... $150/$25

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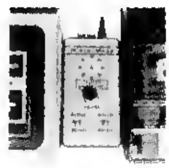

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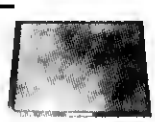

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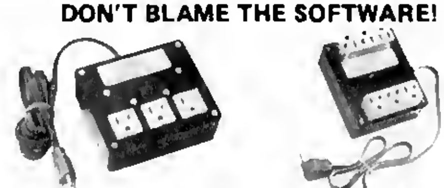

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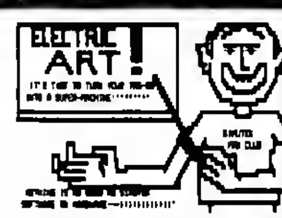

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```
2020 PRINT@390,"THE NINE STEPS ?": PRINT@468,"( Y/N )"
2030 A$=INKEY$: IF A$="" GOTO 2030
2040 CLS: X=USR(0)
2050 IF A$="N" GOTO 2300
2060 PRINT@68,"THESE ARE THE 9 STEPS YOU WILL USE TO DE
     VELOP YOUR FILM:": X=USR(0): Y=7: GOSUB 3850  : GO
     SUB 3000
2070 POKE 16526,20
2080 PRINT@256,"1. LOAD",,"LOAD IN TOTAL DARKNESS": X=U
     SR(0): GOSUB 3000
2090 PRINT"2. DEVELOP",,"THIS STEP DOES THE REAL WORK":
      X=USR(0): GOSUB 3000
2100 PRINT"3. STOP-BATH",,"STOPS DEVELOPING ACTION": X=
     USR(0): GOSUB 3000
2110 PRINT"4. FIX",,"MAKES NEGATIVES PERMANENT": X=USR(
     0): GOSUB 3000
2120 PRINT"5. RINSE",,"BEGINS WASHING": X=USR(0): GOSUB
      3000
2130 PRINT"6. HYPO-CLEARING AGENT","REMOVES FIX CHEMICA
     LS": X=USR(0):GOSUB 3000
2140 PRINT"7. WASH",,"REMOVES REMAINING CHEMICALS": X=U
     SR(0): GOSUB 3000
2150 PRINT"8. WETTING AGENT","HELPS PREVENT STREAKING":
      X=USR(0):GOSUB 3000
2160 PRINT"9. DRY": X=USR(0): GOSUB 3000
2170 POKE 16526,251
2180 PRINT:PRINT"PRESS THE "CHR$(34)"ENTER-KEY"CHR$(34)
     " TO CONTINUE";: X=USR(0): INPUT A$
2190 POKE 16526,237: X=USR(0)
2300 REM
                         *  LOAD  *

2310 CLS:
     PRINT CHR$(23): PRINT@78,"**  LOAD  **"
2320 PRINT@260,"LOAD YOUR DEVELOPING TANK": PRINT@332,"
     IN TOTAL DARKNESS."
2340 PRINT@448,"WHEN THIS IS COMPLETED, YOU MAY   CONTI
     NUE UNDER ROOM LIGHTS."
2342 Y=40: GOSUB 3800:
2345 PRINT@760,"WOULD YOU LIKE SOME HELP MIXING
      THE DEVELOPER ?": PRINT@916,"( Y/N )"
2346 A$=INKEY$: IF A$="" GOTO 2346
2347 IF A$="N" GOTO 2580
2348 CLS: X=USR(0)
2350 PRINT CHR$(23): PRINT"NOTE THE AMOUNT OF CHEMICAL"
     : PRINT"SOLUTION NEEDED TO COVER ALL": PRINT"THE R
     OLLS OF FILM YOU ARE": PRINT"DEVELOPING.  THIS IS
     CALLED:"
2351 GOSUB 3000: GOSUB 3000
2352 FOR I=0 TO 10: PRINT@388,"
     ": FOR I2=0 TO 30: NEXT I2: PRINT@388,CHR$(34)"TOT
     AL WORKING SOLUTION"CHR$(34): FOR I3=0TO90: NEXT:
     NEXT
2360 GOSUB 3000
2370 PRINT@512,"EXAMPLE:": FOR I=0 TO 1000: NEXT: PRINT
     @520,"  IF YOUR TANK REQUIRES 10 OZ PER ROLL OF FI
     LM AND
YOU ARE DEVELOPING 2 ROLLS,YOUR TOTAL WORKI
     NG SOLUTION = 20 OZ."
2375 GOSUB 3000: GOSUB 3000: GOSUB 3000
2380 Y=43: GOSUB 3800: PRINT@832,"WHAT IS YOUR":  PRINT
     @896,"TOTAL WORKING SOLUTION";: INPUT ST: CLS: X=U
     SR(0)
2425 IF ZQ=3.149 GOTO 3440
2500 REM
                  * MIXING OF DEVELOPER *

2510
     ON D GOSUB 3110  , 3120  , 3110  , 3110  , 3110  ,
      3110  , 3120
2520 PRINT CHR$(23): PRINT@74,"MIX THE FOLLOWING:": PRI
```

program continues

alphanetics

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```
     NT
2530 PRINT TAB(2)SS; TAB(8)"OUNCES OF ";D$
2540 PRINT TAB(2)SW; TAB(8)"OUNCES OF WATER"
2550 PRINT"-------------------------------"
2560 PRINT"FOR A TOTAL WORKING SOLUTION OF";TAB(25);ST;
     "OUNCES"
2570 PRINT@768,"WHEN THE ";D$;" IS MIXED,": INPUT"PRESS
      ENTER.";A$
2580 CLS: X=USR(0)
2600 REM
                *  DEVELOP  *

2610 CLS: PRINT
     @84,"**   DEVELOP   **"
2620 PRINT:PRINTTAB(5)"WE ARE DEVELOPING:",F$,"FILM"
2630 PRINTTAB(5)"USING:",,D$,"DEVELOPER"
2640 GOSUB 3130
2700 REM
                *  STOP-BATH  &  FIX  *

2710
     CLS: PRINT@84,"**  STOP-BATH  **"
2720 PRINT@270,"ADD COMMERCIAL STOP-BATH OR WATER"
2730 M=1: GOSUB 3130
2740  CLS: PRINT@84,"**     FIX     **"
2750 PRINT@192,"ADD THE FIX. IF THE FIX IS FROM NEW STO
     CK, THE  FIXING TIME CAN BE DECREASED BY PUSHING T
     HE SPACE-BAR (DURING THE TIMING CYCLE)"
2760 M=10: GOSUB 3130
2800 REM
                *  WASH CYCLE *

2810 CLS: PRI
     NT@84,"**    RINSE    **"
2820 PRINT@274,"RINSE FILM WITH WATER": N=1: GOSUB 3130

2830 CLS: PRINT@80,"**  HYPO-CLEARING AGENT  **"
2840 PRINT@274,"ADD HYPO-CLEARING AGENT": M=2: GOSUB 31
     30
2850 CLS: PRINT@84,"**     WASH     **"
2860 PRINT@271,"WASH FILM UNDER RUNNING WATER": M=5: GO
     SUB 3130
2870 CLS: PRINT@84,"**     DRY     **"
2880 PRINT@263,"RINSE FILM WITH WETTING AGENT, THEN HAN
     G TO DRY"
2890 PRINT@832,""
2990 END
3000 FOR X=0 TO 1000: NEXT: RETURN:    REM   *  2 SEC D
     ELAY *
3100 REM
                *    MIX ROUTINE   *

3110 SS=
     ST: SW=0: RETURN
3120 SS=ST/2: SW=SS: RETURN
3130 FOR I=0 TO 500: NEXT I
3300 REM
                *   CLOCK ROUTINE   *

3310 Y
     =16: GOSUB 3850
3315 PRINT@385,"   PRESSING THE "CHR$(34)"SPACE-BAR"CHR
     $(34)"  WILL INTERRUPT THE TIMING CYCLE ";: GOSUB
     3000
3320 PRINT@529,"TOTAL TIME: ";M;" MINUTE (S)"
3330 POKE 16526,52: X=USR(0)
3340 PRINT@650,"PRESS THE  "CHR$(34)"ENTER-KEY"CHR$(34)
     "  TO BEGIN TIMING";
3350 PRINT@733,"";: INPUT A$
3360 IF M<>3.75 GOTO 3370  ELSE M=3: S=45: GOTO 3380
```

program continues

PROGRAMMING TOOLS FOR YOUR TRS-80

INSIDE LEVEL II

The Programmers Guide to the TRS-80 ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Level II ROMs which allows the machine language or Basic progremmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, end mathematical functions, as well as keyboard, tape, end video routines. Part II presents an entirely new composite progrem structure which loads under the SYSTEM command end executes in both Basic and machine code with the speed and efficiency of e compiler. In addition, the 18 chapters include e lerge body of other information useful to the programmer including tape formets, RAM useage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic veriables directly with machine code, a method of greatly increasing the speed at which data elements are stored on tape, and special precautions for disk systems. INSIDE LEVEL II is e clearly organized reference manual. It is fully typeset and packed with nothing but useful information. It does not contain questions and answers, ROM dumps, or cartoons. **INSIDE LEVEL II..... 15.95**

TELECOMMUNICATIONS PROGRAM

This program allows reliable high speed file transfers between two disk-based computers over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminel mode, save RAM bufter on disk, transmit disk file, receive binary files, examine and modify UART peremeters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and meny more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission wes accurete. **TELCOM.....$29.95**

PROGRAM INDEX FOR DISK BASIC

Assemble en elphabetized index of your entire program librery from disk directories. Program names and free space ere read automatically (need not be typed in) end may be alphabetized with a fast Shell/Metzner sort by disk or program. The list may elso be searched for any disk, program, or extension; disks or programs added or deleted; end the whole list or any part sent to the printer. Finally, the list itself mey be stored on disk for future access and update. "The best thing since sliced bread" (Janvery issue of '80 Microcomputing). One drive and 32K required. **INDEX.....$19.95**

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STEP80 allows you to step through any Basic or machine lenguage program one instruction et a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so thet the "target program" may perform its display functions unobstructed. STEP80 will follow program flow right into the ROMs, end is en invaluable aid in learning how the ROM routines function. Commends include step (trace), disassemble, run in step mode at varieble step rate, display or alter memory or CPU registers, jump to memory location, execute e CALL, set breakpoints in RAM or ROM, and relocate to any pege in RAM. The displey may also be routed to your line printer through the device control block so custom print drivers are autometically supported. **STEP80.....$16.95**

4 SPEED OPTIONS FOR YOUR TRS-80!

The SK-2 is the most versatile clock modification available for the TRS-80. Speeds mey be switched between normal, an increase of 50%, or a 50% reduction; selectable at any time without interrupting execution or crashing the program. Instructions are also given for a 100% increase to 3.54 MHz, though the TRS-80 is not reliable at this speed. The SK-2 may be configured by the user to change speed with a toggle switch or on software command. It will autometically return to normal speed any time a disk is active, requires no change to the opereting system, and has provisions for edding en LED to indicate when the computer is not at normal speed. It mounts inside the keyboard unit with only 4 necessary connections for the switch option (switch not included), and is easily removed if the computer ever needs service. The SK-2 comes fully assembled with socketed IC's and illustrated instructions. **SK-2.....$24.95**

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This program is a full feature print formatting package featuring user defineable line and page length (with line feeds inserted between words or after punctuation), screen dump, and printer pause control. The serial version allows baud rate selection from the keyboard. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Please specify PARALLEL or SERIAL (RS-232 interface) version. **SPOOLER.....$18.95**

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This complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, and 48K machines, a short sample Basic program to access them, e 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines use variables defined by a supporting Basic progrem to make data entry and retrieval extremely fast and easy for custom implementation. They perform 20 to 40 times fester than their Besic equivalent (256 points in 12.5 seconds), and require less than 1550 bytes of memory. **FFTASM.....49.95**

FOR THE MODEL II

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from Midnight Software

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MUMFORD MICRO SYSTEMS

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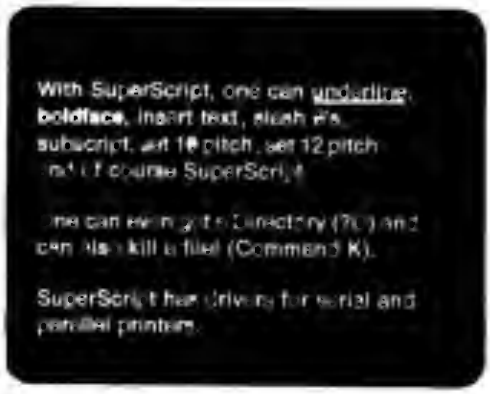
✓Reader Service--see page 242

FOR USE WITH LOWER CASE MODIFICATION

SUPERSCRIPT

by Richard Wilkes



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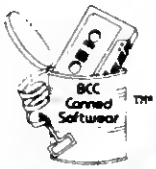

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```
3370 M=M-1: S=60
3380 S=S-1
3390 I$=INKEY$: IF I$ =" " GOTO 3600
3400 IF S<0 THEN M=M-1: S=59
3410 IF S=30 OR S=59 PRINT@912,"AGITATE THE DEVELOPING
     TANK";
3420 IF S=25 OR S=55 PRINT@912,"
          ";
3425 IF ZQ=3.149 GOTO 3440
3430 IF M=0 AND S=0 GOTO 3600
3440 PRINT@650,"          -=  REMAINING TIME  =-
          ";
3450 Y=34: FOR X=45 TO 75: SET(X,Y): NEXT: SET(45,35):
     SET(45,36): SET(45,37): SET(45,38)
3460 Y=39: FOR X=45 TO 75: SET(X,Y): NEXT: SET(75,35):
     SET(75,36): SET(75,37): SET(75,38)
3470 PRINT@794,M;" : ";S;
3480 POKE 16526,223: X=USR(0)
3490 FOR X=30000 TO TZ: NEXT
3500 GOTO 3380
3600 REM
                *   ALARM  ROUTINE   *

3610 I
     F ZQ=3.149 GOTO 560 ELSE CLS: PRINT@212,"!!!  S T
     O P  !!!"
3620 POKE 16526,104
3630 X=USR(0)
3640 POKE 16526,223:   REM *  BLOOP  *
3650 PRINT@349,"!": X=USR(0):  PRINT@413,"!": X=USR(0):
       PRINT@477,"!": X=USR(0)
3660 PRINT@598,"EMPTY THE TANK"
3670 POKE 16526,251:    REM  *  SPLAT  *
3680 X=USR(0)
3690 GOSUB 3070
3700 PRINT@043," PRESS THE "CHR$(34)"ENTER-KEY"CHR$(34)
     " FOR NEXT STEP";
3710 INPUT A$: POKE 16526,237: X=USR(0): RETURN
3800 REM
                * MOVING FILM STRIP *

3810  F
     OR X=0 TO 115: SET(X,Y): NEXT X
3820 FOR X=0 TO 115 STEP 2: RESET(X,Y): NEXT X
3830 FOR X=0 TO 115: RESET(X,Y): NEXT X
3840 RETURN
3850 REM        *   HORIZONTAL LINE   *
3860 FOR X=0 TO 127: SET(X,Y): NEXT: RETURN
3870 REM        * BROKEN HORIZONTAL LINE *
3880 FOR X=0 TO 127 STEP 2: SET(X,Y): NEXT: RETURN
3900 REM
                *  ERROR MESSAGE  *
3905 CLS: POKE 16526,251: X=USR(0)
3910 CLS: PRINT CHR$(23): PRINT@404,"S O R R Y ,": PRIN
     T@530,"INPUT ERROR.": PRINT@778,"PLEASE SELECT, AG
     AIN."
3920 FOR X=0 TO 3000: NEXT: RETURN
```

The finest music synthesizer for the TRS-80 is now only $149.

By focusing on direct sales to the consumer, and eliminating the dealer mark-up, we can now offer the MUSIC BOX at this new low price!

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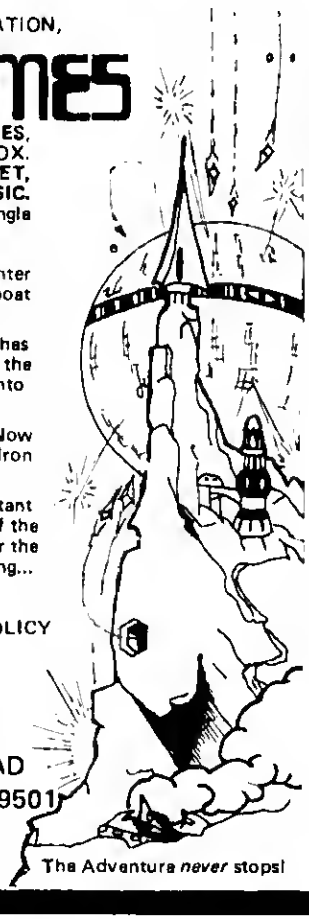

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Software for TRS-80s

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Radio Shack Versus The Competition

From the moment a 4K TRS-80 owner first looks longingly at the 16K memory size of a friend's CRT, the urge to upgrade is countered by uncertainty. Should the next stop be the nearby Radio Shack or the enemy at Vinnie's House of Computers?

David D. Busch
515 E. Highland Avenue
Ravenna, OH 44266

If you are a dedicated hardware hacker for whom words like Altair or 8008 hold deep nostalgia and who is not frightened by NAND gates, the question is irrelevant. You can take anything even remotely compatible with your TRS-80 and make it work, somehow. If your gear breaks down, you can fix it.

In introducing their affordable turnkey system, Radio Shack attracted a horde of new computerists loathe to homebrew anything more complicated than a cup of coffee. These microcomputer hobbyists went to be able to plug in their systems and use them with a minimum of trouble.

There are seven common areas of expansion in which the owner is faced with Tendy vs. other choices:

- Additional keyboard memory;
- Expansion interface memory;
- Disk drives and other mass storage alternatives;
- Lowercase conversion kits;
- Software;
- Printers;
- RS-232, Modems, etc.

Kayboard Memory

For those who are really new to the TRS-80, this subject was hot some months back. Radio Sheck wee cherging $299 for the upgrade from 4K to 16K, and you didn't even get to keep your 4K RAM chips.

Some enterprising souls who noticed that Tandy was selling TRS-80s in the ten thousands began offering 16K memory upgrade kits for $150 or less. And less. And less. At this writing, Radio Shack has come down to $230 for the first 16K of memory, with a $119 tag on each additional increment, but you get a nifty calculator-style keyboard with the CPU memory upgrede.

The RAM chips alone can be had from other sources for $49 to $89 with appropriate jumpers for the keyboard thrown in or available for a nominal fee. With prime chips from a reputable source with a good guarantee, there seems to be little potential problem in using non-Radio Shack memory in your keyboard. The extremely timid might want to wait until the 90-day warranty has expired before opening the CPU, but the actual upgrade is a simple task for even the notoriously fumble-fingered.

My chips were Ithaca Audio RAMs purchased in the $119 dark ages, and though the keyboard has been back at Radio Shack for several mods since then I've had no complaints from the service personnel and absolutely no problems.

Expansion Interface Memory

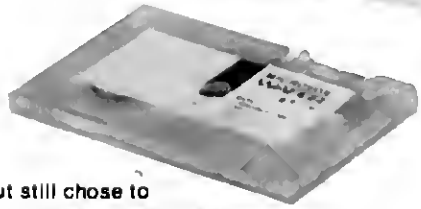
With memory separated from the Z-80 chip by a foot and some strange ribbon cable, memory compatibility becomes more important. Those who have problems pinning down what's wrong when their computer ails may not like the added variable of dubious memory chips. I've seen knowledgeable hardware folks shuffle different RAM chips in and out of their expansion interfaces, running various memory tests until they found a set of eight or sixteen that performed to their satisfaction.

Many brands of memory probably work perfectly well in any interface. At the time I purchased mine, Radio Shack was phasing out buffered interface cables, retrofitting twisted pair mods to other units, and, in some cases, swapping memory chips, because a few clinkers had slipped into their own supply. With the price down to $119, it was worth an extra $50-70 per 16K to be able to dump the thing in their laps if my RAMs became forgetful. I upgraded to 48K, using Radio Shack memory for the final 32K.

Mass Storage Alternatives

The specialized mass storage devices, Stringy Floppies, Poor Man's Floppies, etc. exist for a very good reason: Cassette data transfer and program storage/retrieval is darned slow. Each of these can be had for hundreds of dollars less than the expansion interface/disk drive combination. If you have no need of memory beyond 16K, and don't need or can't afford the features of disk systems, by all means consider one of the alternatives. They can't hurt your system; Radio Shack offers nothing to compare with them and many happy users attest to their reliability.

In my case, I was aiming at a disk system. I carefully considered all the alternatives,



In writing 2,000 words per day on my computer, I tend to look at the screen a lot, and couldn't bear the lopsided character set of the simplest modifications

but still chose to purchase two Radio Shack disk drives. Others, with different circumstances, might be better off with one of the other brands. At our local users' group, I had the chance to observe and test a variety of disk drives before making my decision. The pros and cons were as follows.

The other brands of drives that I liked best offered quicker track-to-track access times for faster operation, supported 40 tracks vs Radio Shack's 35, and could write to both sides of a 5¼-inch diskette. They were generally about $140 cheaper, to boot.

I discovered that Radio Shack was not quite as serious a disadvantage as might appear on the surface. The drives that I ended up purchasing function quite well as 40-track drives, using a 40-track DOS, such as NEWDOS+. I've punched extra index and write-enable holes in more than 100 diskettes, and have found only a few that are not fully usable on both sides. Various patches have speeded up my drives' access times a little, but I'm entirely satisfied with their speed. My system is booted up before the CRT warms up in the morning, and most programs are loaded and ready to run before I can decide what to do with them.

About that $140.... I count that as an investment in maintaining nearby, convenient service facilities. As a writer who depends heavily on my computer for word processing, I'm not pleased with the idea of sending a much needed disk drive off to the manufacturer for repair. My local Radio Shack not only provides one day turnaround on fixes, but, in one case, gave me a totally new drive rather than make me wait while the lemon I purchased made its third trip back to the shop.

Because I use my computer in business, that $140 extra I paid for each of the drives can be equated with potential lost income, so the choice for me was an easy one. For those of you who must weigh computer purchases against an extra day of vacationing, or that new lawnmower, service might have an entirely different perspective.

In summary, both Radio Shack's and other manufacturer's drives offer nearly equivalent operation, but, the non-hardware oriented microcomputer hobbyist may want to have the Radio Shack service center to lean on in times of distress.

Lowercase Conversion Kits

This is another sticky area, because of the wide disparity in cost between Radio Shack's $59 lowercase mod, and the $15-$30 price tag on other conversion kits.

I elected to go for the $59 lowercase, because of my personal reluctance to tamper with my keyboard, and the importance I placed on descenders. In writing 2000 words per day on my computer, I tend to look at the screen a lot, and couldn't bear the lopsided character set of the simplest modifications. The more sophisticated kits came close enough in price to Radio Shack's mod that the difference to me was negligible.

I have experienced few of the forewarned problems that might be caused by the changes made by the modification. When the lowercase driver is loaded, NEWDOS seems to perform exactly as intended, including the JKL function. Some programs that PEEK at video memory are unnerved at finding the value of 1 for an uppercase A, rather than the expected 65. It is simply a matter of inserting a line along the order of:

```
XXX A = PEEK(N):IF A<32 THEN A = A + 64
```

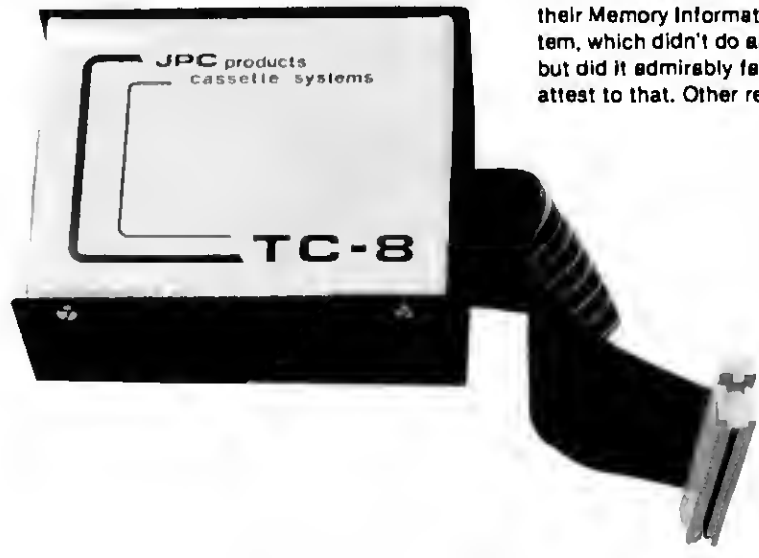
where XXX is the line number, A is the variable used for whatever purpose in the program, and N is the video memory address (between 15360 and 16382 decimal).

Other lowercase modifications give you a control key, but at the time I ordered mine, I already knew that Scripsit had everything I needed in a word processing program.

Software

Scripsit might be a good place to start, because this program could be the beginning of a much needed resurgence for Radio Shack's software reputation. It works! After 15 years of writing on manual and electric typewriters, I hope I never see their ugly little keyboards again.

All is not so rosy with other Shack software. As an early purchaser of their Memory Information System, which didn't do anything, but did it admirably fast, I can attest to that. Other reviewers



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ISAR EXPANDED comes with three additional modules:

- One allows you to use your GSF program for even faster sorting on up to 10 different sort keys! Another will allow you to redefine a file by making an existing field larger or adding a field to each record. The last will merge two **ISAR** files with the same format.

reviewers have put in their two-cents' worth on the value of other Radio Shack programs intended for business and personal use. But, with gems like Scripsit issuing from Ft. Worth, the future looks brighter.

In the meantime, TRS-80 owners continue to revel in the treasure trove of well written, useful software available for their computer. Choosing between Radio Shack and other software to do the same job generally is no choice at all, especially in the area of disk operating systems and business programs.

There is always the danger of bugs in software from unknown vendors, and a lack of support. But, it almost appears that an exception to Gresham's Law might apply to software: Good programs tend to drive out the bad. Only rampant piracy threatens the really creative programmers.

Printers

Hard copy devices are another big-ticket item fraught with discounting, price-cutting and heavy competition. At Radio Shack itself, features have mushroomed while prices for printers dropped drastically.

I saved $500 to $1000 by purchasing an Integral Data Systems IP125 printer on close-out at a local computer store. Predecessor to the popular Paper Tiger, it boasts many of the same features, including eight different print sizes. There is no tractor feed, but it has a flat paper tray that allows me to feed 8½ × 11-inch typing paper one sheet at a time just as if I were operating a photocopier.

The printing is sharp and legible (though there are no descenders on the lowercase letters), and I can send the copy off to a finish typist for letter-quality typing. Some of the magazines I write for, particularly computer magazines, don't mind receiving the dot-matrix printing, so I can forgo the last step. Until the day when I can afford a daisy-wheel type printer, my unit suits my needs perfectly.

Why not Radio Shack, considering the heavy use I give the printer? In this case, the local computer store offers in-town service. But, so far, the only problems I've had have been with mechanical ailments. After 15 years of tangling with the linkages in a variety of typewriters, I'm entirely comfortable tinkering with the rollers, gears, and solenoids in my printer. Usually a small adjustment gets me up and running in a few minutes. I steer clear of electronic diagnostics, but these problems appear to be few and far between in the year I've used my IP125 daily.

Printer prices are dropping drastically. Be certain that the printer under consideration will mate with the TRS-80, and not just be made to mate. Except for writers, printers are rarely the must-have item that cause all operation to cease while repairs are underway. Even businesses can read their reports off the CRT screens if need be.

Modems and Serial Interfaces

There's not a lot of controversy here. Radio Shack's RS-232 serial interface is not outlandish at $99, when you consider the trepidation that we non-hardware types feel at the thought of assembling even a simple kit.

Their $199 modem is only $10-$30 more expensive than the suspiciously similar in appearance models available from other sources.

Take your choice: More sophisticated modems with extra capabilities, like auto-answer, are available, and some direct connect units contain their own serial interface. Whether you go with Radio Shack or not, the money involved is not huge either way, and it's difficult to go wrong. Even more so than printers, modems are not likely to be must items in anyone's computer system.

If the modem is the only peripheral connected to the serial interface, and no others, such as a printer, are dependent on the RS-232, it may be nearly painless to depend on the manufacturer for service.

When I get my own units, I'll probably lean toward Radio Shack's, if only for the ability to have them check out everything, from CPU on up, if something goes awry. ■

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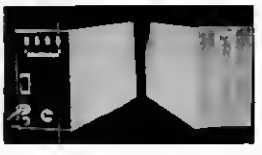

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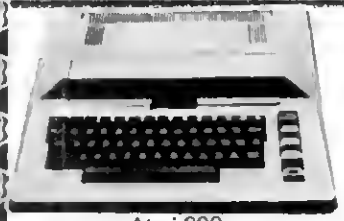
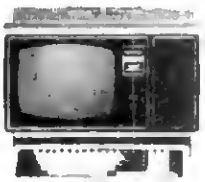
 Atari 800 $749	1-8K plug in RAM Module FREE ($124.95 value)	1 Box (10 Pcs) 8" Diskettes FREE	 TRS-80 Model II - $3449
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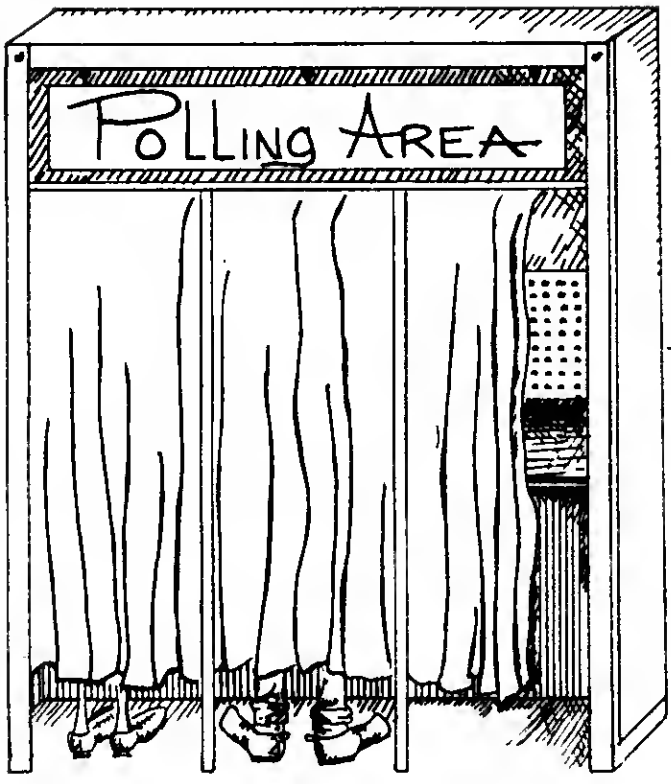

A story of how one users group computerized election eve returns for the local TV station.

Tally With an 80

Roderick D. Graham
George L. Haller
1500 Galleon Dr.
Naples, FL 33940

Around the first of March, the News Editor of the local radio and television stations approached the Collier County Computer Club for assistance in the stations' presentation of the primary vote results for Collier county. The results of main interest were the Democretic Presidential Preference, with five candidates running; the Republican Presidential Preference, with nine candidates running; and the races for Committeeman end state committeewoman, with two candidates each. There were also three other contests to be reported: The constitutional amendment to increase the Homestead exemption, the bill to modify the duties of the Florida Supreme Court and the county-wide vote for a penny gasoline tax.

There are thirty-six precincts in Collier County and ballots were expected to run to about 20,000. The ballots were brought to the court house for computer processing and a summary of each precinct's results were duplicated and given to the media in hard copy. These summaries became available shortly after seven p.m., and it was expected that they would all be available by eleven.

Hourly News Reports

We agreed to input the precinct results into the computer as they were made available to us, and summarize them for hourly news reports through eleven p.m. The club decided to use the TRS-80. Several members have this computer and we wanted two computers working, one as a backup. The expanded letters on our screen were better for viewing, and we could use the INKEY command to allow rolling from one full screen to the next without a question mark showing. We tried feeding our signal directly into the TV station modulator but we had better success feeding into one of their monitors from which they could pan their camera on and off as they desired. This monitor was coupled in parallel with our two computers and could be switched from one computer to the other by means of a simple single pole switch.

The programs were fairly simple to outline but the more we worked with them the more complex they became. We decided to work-up three programs: a main program, a backup program, and a reload program, for use in case of a bad crash to both computers. The Collier County Computer Club did not want to fall on its face in front of a county-wide audience, so we added many fail safe features to all three programs.

The main program accepted votes by precinct number, and candidate or proposition name. The input was then reviewed for corrections before going on to the next race in the precinct.

The main program menu was:

1. Enter a new precinct.
2. Display individual precinct results on the TV monitor.
3. Present the summary of the available precincts on the TV monitor.
4. Save data to disk.
5. Recover data from disk.

The backup program automatically saved only the summary data on disk for recovery purposes after each precinct entry. At the operator's discretion, a printout could be made on a small printer so that in case of a catastrophic failure, we could reenter the summary data from the keyboard and go on from there, using either the third program or, by entering the summary data as if it were a single precinct data and changing the total number of precincts, use program number one.

Ran Simultaneously

We ran the first two programs simultaneously and they were periodically compared for accuracy. In the dry runs before election day we experienced some disk save failure because of power line glitches, so we decided to run the main program without saves. At the end of the evening we were able to save the whole data array without any problem. The array was 28 candidates by 36 precincts, over 1000 elements.

The logistics were as follows. There were two computer operators and two readers. A project manager made sure the overall operation ran smoothly. He received the summary sheets, edited the extraneous material and passed the sheets to the readers. He also kept an account of the precinct sheets processed.

The evening was completed successfully, and while we didn't need the backup computer for the TV presentation, it was comforting to see it performing and checking the results of the main computer. The media people were very generous and gave us quite a bit of on-the-air publicity during the operation. The listings of the programs we used are available from the Collier County Computer Club, c/o Dr. G. L. Haller, 1500 Galleon Dr., Naples, FL 33940. ■

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✓ Reader Service—see page 242

Sound Strange? Not so.
See how this hardware mod can put your old 4K memory chips to use.

Mem Size. . . 20K!

W. R. Stanley N4TF
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When you installed a set of 16K memory chips in your computer, what did you do with the 4K set that came out?

Do you find occasions when that cure-all-memory-problem 16K set is not quite enough to contain that long program you're working on, along with an assembly language monitor and a couple of utility programs?

Let's put that extra 4K memory set to good use. Don't worry, no internal changes to the keyboard unit are necessary.

Background

Correct operation of any external circuit connected to the keyboard will depend upon appropriate address selection, your use of the data bus and the control signal you employ in an exact sequence. For example, an external memory cell location must be addressed to the exclusion of all other cell locations in that memory, if it is to share in data transfers to and from the keyboard.

The parallel eight-bit data bus at the keyboard connector is an extension of the data bus routed inside the keyboard to several discrete memory blocks (ROM, RAM, video memory, and the keyboard itself). The external memory circuit to be added to the computer must be brought onto the data bus only when data are to be written to or read from that memory block.

Address and control signals from the keyboard insure that this external memory block is enabled only when called upon by the CPU. At all other times the external memory block must appear transparent (non-existent) to the main computer.

The 4K dynamic chip as used in the TRS-80 is packaged in the standard 16-pin DIP package. One pin serves as the date input point, while a second one is used for data bit output.

Three pins are used for power inputs (+12, +5, −5 V). An additional pin is grounded for signal and power path returns. One further pin is used for a Chip Select control signal to activate the memory chip for a read or write operation.

Still another pin receives a control signal telling the chip whether the current operation is a read or a write.

So far, eight of the 16 pins have been accounted for, leaving eight more. Yet we must apply 12 bits of addressing information to the chip designating the exact memory cell locations to be affected by the chosen operation.

Why 12?

Consider the number of address line bits necessary to address each of the 4096 memory cell locations on the chip (from 0000 to 0FFF hex). Two raised to the 12th power equals 4096.

The Memory Matrix

The 16-pin memory chip addresses its memory as a matrix, in rows and columns. Picture a grid of 64 horizontal wires overlaid by 64 vertical wires (64 × 64 = 4096). Any intersecting point in the grid can be located by specifying the row number and column number.

The memory chip is addressed by applying data that designates the row number of the desired memory bit location, latching that row address into the chip logic and control circuits, and then latching the column address presented a short time later. This address method (called multiplexing) can address any location on the 4K chip using only six address pins instead of 12.

Two additional pins on the chip are used for signal inputs to tell the chip's internal circuits whether a row-address group or a column-address group is being entered. All 16 pins are now accounted for.

Consider one more function. The value of a given data bit stored at a particular address on the dynamic memory chip is represented by the charge level (high or low) of a capacitor at that memory matrix location.

As you know, the level of charge on a practical capacitor changes over time. This charge must be restored periodically at each capacitor cell location. This is known as the refresh operation. In the TRS-80, the Z-80 CPU performs refresh operations at the same time it decodes a machine instruction. A special register on the CPU chip keeps track of the row address groups and insures that all memory matrix row addresses are accessed in the proper order. Regardless of the amount of dynamic memory on line, all cells will be refreshed approximately 500 times per second.

Block Diagram

Fig. 1 is a block diagram of a 4K dynamic memory card that can be directly connected to the keyboard. Its address decoder is the principal circuit that determines when external memory is brought on line.

Since all locations in a 4K

memory block can be addressed using 12 address lines (A_0-A_{11}), and an additional four address line bits (A_{12}-A_{15}) are available, those four bits can be used to arbitrarily assign an address block location to the external memory board.

The logical place to locate the additional memory block is in the range of 8000-8FFF hex. This places the external memory immediately above the internal 16K block, whose highest address is 7FFF hex, without leaving a gap.

The address decoder constantly monitors the four highest-order address line bits. It outputs an enabling signal only when the computer address bus contains addresses in the 8xxx hex range (when A_{15} is high, and A_{12} through A_{14} are low).

If the address decoder circuit senses any other combination of signals on the address bus, it disconnects the remainder of the memory board circuits.

The address multiplexer (Fig. 1) performs as an electronic six-pole double-throw switch. In one position of the switch, address lines A_0-A_5 connect to the memory chips. In the other position, lines A_6-A_{11} are routed to the chips. The MUX (Multiplexer) signal, which is the output of a flip-flop in the keyboard, determines the electrical position of the double-throw switch.

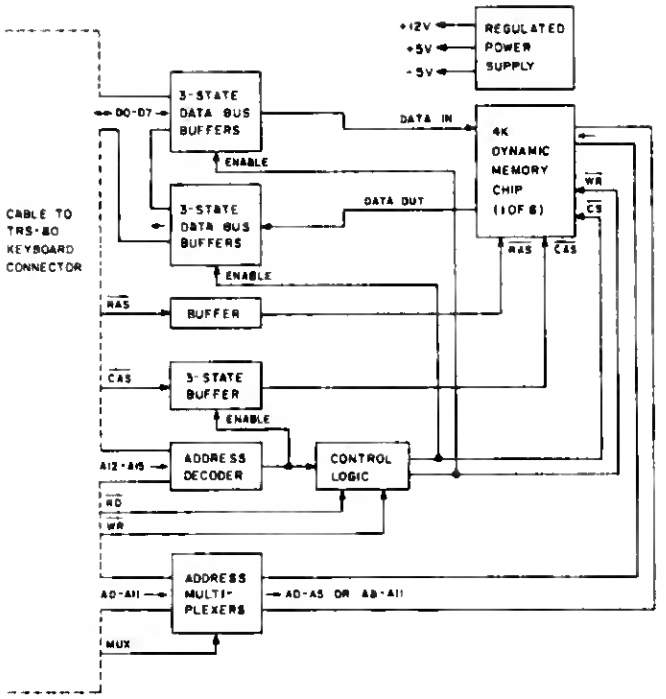

Fig. 1. Block Diagram of the 4K Dynamic Memory Board

The MUX signal has a predetermined phase relationship to the $\overline{RAS}$ (Row Address Strobe Not) and $\overline{CAS}$ (Column Address Strobe Not) signals also generated inside the keyboard. When the $\overline{RAS}$ signal is present, either during the early part of a memory read or write cycle, or during a refresh operation, the phase of the MUX signal is such that the address multiplexer outputs the low-order address group (A_0-A_5) to the memory chips.

When the $\overline{CAS}$ signal is present, the MUX signal phase is reversed, and the multiplexer outputs the high-order address group (A_6-A_{11}) to the chips.

Note that the $\overline{RAS}$ signal is applied through a buffer to memory. Buffering this signal causes the keyboard circuit that provides that signal to see only one additional load rather than eight more.

Note also that the $\overline{CAS}$ signal is applied through a three-state buffer. This buffer is operational

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8. The **RESTRUCTURE DATABASE MODULE** gives you the ability to read the records of any **RADEX-10** or **UDBM** file and then write those records onto another file with a different file structure, thus allowing you to **ADD, DELETE,** or **CHANGE FIELDS** of a database file without having to re-key-in the data.

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✓Reader Service—see page 242

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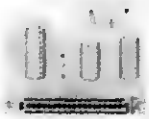

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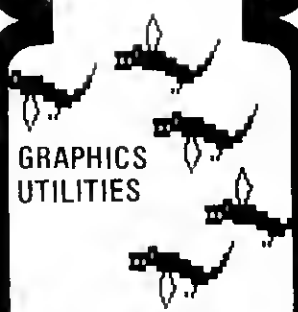

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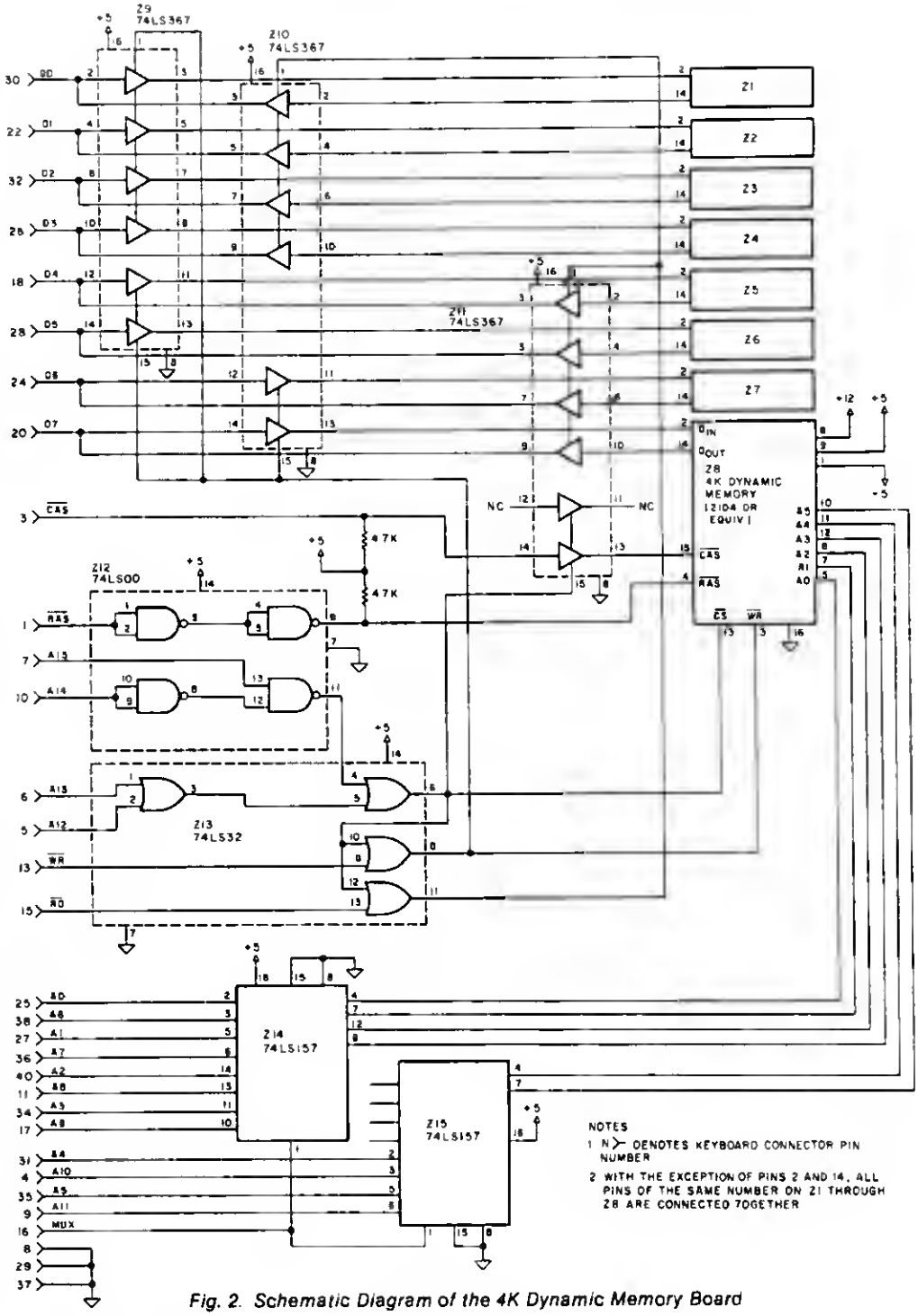

Fig. 2. Schematic Diagram of the 4K Dynamic Memory Board

only when the address decoder senses addresses in the *8*xxx hex range. The $\overline{CAS}$ signal is therefore applied to the external memory chips only when those chips are written to or read from.

Two additional control signals from the keyboard connector tell the external memory whether it is being written to or read from. These signals are, respectively, $\overline{WR}$ (Write Not) and $\overline{RD}$ (Read Not).

Note that these signals are also combined with the address decoder output so that the memory chips are not placed in the read or write condition unless the proper address range is on the computer address bus.

The $\overline{CS}$ (Chip Select Not) signal is present when the $\overline{RD}$ signal and the proper address decoder output appear in the same time frame.

Construction

The schematic diagram of the 4K memory board is shown in Fig. 2. The layout is not critical; however, I suggest that you spend a little time trying different component arrangements before you start wiring.

I constructed my circuit on a Radio Shack Cat. #276-152 Plug-In Breadboard. This card provides ample room for construction of the memory circuit. It also has 44 pins on its board edge, which means that its pin number assignments can be directly

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Reader Service—see page 242

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```
10  GTO "ENTER A LINE"
20  REM  LINE 10 IS THE SAME AS 'GOTO 30'
30  JNAME "ENTER A LINE" : INPUT A$
```

  How many times have you wanted to use variables to reference line numbers? Now you can! GTO and CSUB allow variable expressions as operands, such as: GTO X+40 or CSUB (Y*I0)+30.
- **WHILE / WEND**-New, structured programming loop construct. Makes for more logical program flow.
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  EXEC executes a string expression *as if it were a BASIC program line!* For example:
  A$ = "PRINT X" : X = 4 : EXEC A$ would result in a 4 printed on the screen (that is, execution of the BASIC statement "PRINT X"). With EXEC, your computer can write its own programs and execute them!
- **CALL**-Pass control to machine language sub-routines at any address, passing parameters *both* ways.
- **CLM / PAGE**-Set up automatic page roll-over and other line printer functions from BASIC.
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☐In addition to the above commands, Model I ENHBAS contains vector graphics and drawing commands. Model II ENHBAS has many functions suited to business programming—ISAM file handling commands, RS-232 access, and many more; along with several Model I BASIC commands left out of Model II (PEEK, POKE, etc.).

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correlated with those of the keyboard connector, and still heve four uncommitted pins available for connecting the cerd to an external power supply.

The mating connector is also aveilable et Redio Shack. The proper mating connector for the keyboard is an AMP P/N 88103-1 or its equivalent. You cen get a 40-pin connector with 0.1-inch contact spacing at Priority One Electronics. Consult the advertisements in this and other periodicals for alternate sources.

Note that the pin number assignments on the keyboard connector do not necessarily agree with the order indicated on your mating 40-pin connector. With the keyboard in front of you, pin 1 will be on the top of the circuit board at the connector end ferthest removed from the RESET button. The odd-numbered pins progress in ascending order to the left, with pin 39 on the top left edge. All even-numbered pins ere on the underside of the keyboard connector, with pin 2 directly underneath pin 1. Pin 40 is closest to the RESET button.

Be sure to label the connector that plugs into the keyboard so that its position is correct before insertion. Use dots of fingernail polish or some other marking medium to indicate proper orientation between the memory card and its mating connector. If either cable connection is reversed, you might damage your system.

You can use either ribbon cable or individual stranded wires to join the two connectors. I suggest a maximum length of one foot for either type.

I urge you to employ sockets for all ICs. They are good insurence egeinst heat and static damage for the memory chips. They make troubleshooting end replacing components much easier. Incidentally, either solder or wire-wrap techniques can be used. The more ambitious constructor might consider fabricating e printed-circuit board.

"Note that the pin number assignments on the keyboard connector do not necessarily agree with the order indicated on your mating 40-pin connector."

Make all necessary power end ground connections to all chip sockets. Next, connect all indicated like-numbered pins in parallel on the eight memory IC sockets. Make ell connections between the memory chip sockets and the remeinder of the components on the board.

Following this, wire the address decoder and logic circuits. The last area to be wired is between the card edge pins and the appropriate ICs.

Work slowly, and take a break now and then. Double-check your wiring. Unless printed-circuit techniques ere used, you will end up with several layers of wires placed on top of each other. It becomes difficult to find and correct a wiring error that is buried.

If you arrange the memory sockets in parallel rows on the card, cross-connect the power buses between adjacent chips if possible. This method will lower the impedances of the power distribution leads.

Power supply pins should be bypassed, especially around memory ICs. A 0.1-uF disk capacitor bypassing the +12-V supply pin at every other chip and a 0.1-uF disk at the +5-V pin on alternate memory chip sockets are recommended.

A 0.01-uF disk loceted at the −5-V supply pin on every other

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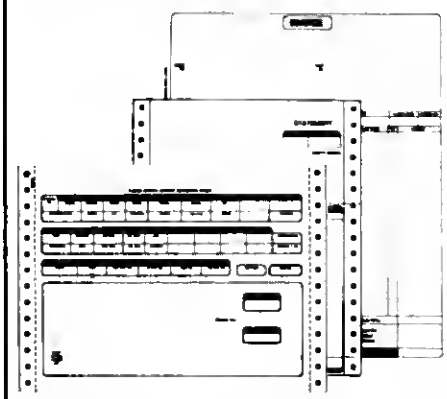

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city, state _____ zip _____
hardware (processor type) _____
software (p/r, a/p) _____
software (a/r, inv) _____
☐ programmer ☐ dealer ☐ CPA/service bureau
☐ end-user ☐ software house ☐ other _____

✓Reader Service—see page 242

memory socket is also advisable. Several 0.01 to 0.1-uF disk capacitors located at the +5-V supply pins on several of the remaining IC sockets would help maintain smooth operation.

One reason for paying particular attention to supply pin bypassing around the memory chips is that high peak currents occur during certain portions of the memory IC operating cycle. Although the average current at each IC is not excessive, those sudden high-current demands could not be met by power supplies located several feet away.

One solution to these abrupt current increases is to connect large capacitors in the immediate vicinity of the memory chips.

The memory board doesn't require much power. But you will find that it costs only a little more to build a power supply that will operate with other circuits. In other words, overbuild the power supply, unless you are interested in the smallest possible package.

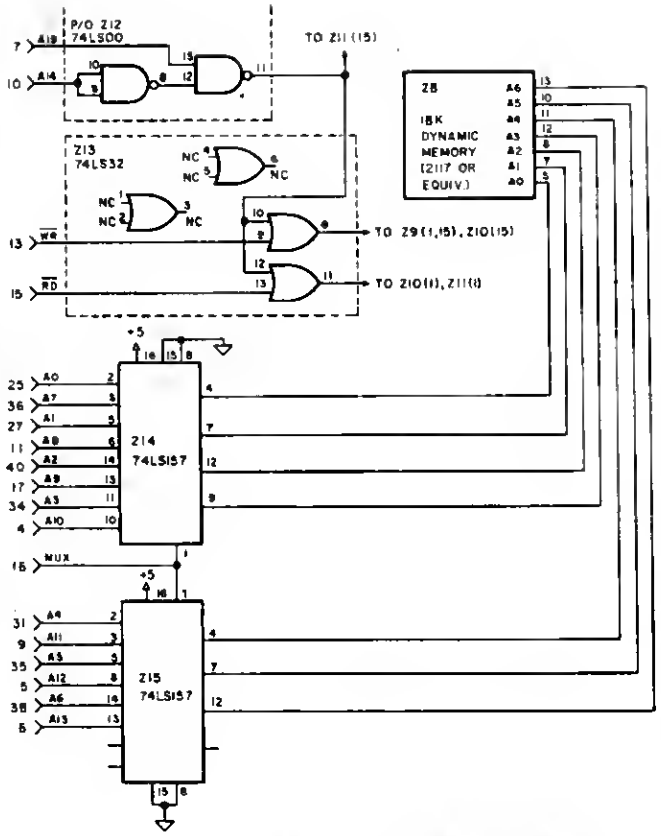

Fig. 3. Partial Schematic Diagram of the 16K Dynamic Memory Board

Junk-box Transformer

I used a junk-box transformer with two low-voltage center-tapped secondaries. The wires between the windings and the terminals on the transformer appeared to be about the right size to handle at least one amp each.

A bridge rectifier across one winding, with the center-tap left disconnected, feeds a 7812 regulator. Both input and output of this regulator chip are heavily bypassed with electrolytics.

In addition, I placed a 0.1 uF disk at both of its active terminals, very close to the package.

A full-wave rectifier is connected across the other secondary winding, whose center-tap is grounded. This rectifier feeds a 7805 regulator, whose input and output are also heavily bypassed.

Another full-wave rectifier, with the diodes reversed from those for the +5-V supply, is connected to another regulator-filter combination. Here a 7905 negative voltage regulator is

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used. Many parts suppliers stock the equivalent of the 7905, listing it as the LM320K-5.

(A 5-V zener diode, bypass capacitor and series dropping resistor can be used in lieu of the 7905 (or equivalent), and you would find that the total cost is about the same. However, this zener regulator does not provide the thermal and overload current protection of the regulator package.)

Mount the 7812 and 7805 on separate small heat sinks, or attach suitable radiators to them. Both of these chips get rather warm. The 7905 does not require heat-sinking because its load current is much lower.

16K Memory Board

You can modify the 4K memory board making it plug compatible to that new set of 16K chips. You need change only the address decoder and address multiplexer circuits to operate the added 16K set in the address range from 8xxx to Bxxx hex (Fig. 3).

Compare the schematics in Figs. 2 and 3. Seven address lines are connected to the 16K chips. (Only six lines went to the 4K set). This means that a total of 14 addressing bits are applied to the 16K chips, in two groups of seven.

The row and column matrix in the 16K chip is a 128 by 128 grid; therefore, seven bits per multiplexed group are necessary.

Adding one address bit per group means that two additional address lines must be added to the multiplexer. This is shown in Fig. 3.

Recall that all 16 pins on the 4K chip are used. What else has to be changed when the seventh address line is added to the 16K chip?

"Recall that all 16 pins of the 4K chip are used. What else has to be changed when the seventh address line is added to the 16K chip?"

The 4K chip has a $\overline{CS}$ pin which enables the chip. Note that the 16K chip has no such pin designation. The manufacturer designed the 16K chip so that it is fully functional when the $\overline{RAS}$, $\overline{CAS}$ and addressing signals are present at the correct times.

Look at the address decoder circuits on the two schematics. The decoder for the 16K memory circuit is simpler, because it responds to a wider range of addresses than the one for the 4K board.

Remember that the 4K board is accessed only when A_{15} is high, and A_{13} through A_{14} are low. This represents an address within the 8xxx hex range. The 16K board is addressed in the 8xxx-Bxxx hex range. This particular range of addresses is present any time A_{15} is high and A_{14} is low.

The address decoder on the 16K board, therefore, has to monitor only two address lines, rather than four.

When you substitute that set of 16K chips in the keyboard for the original 4K set, you have to reconfigure several jumpers. You are actually rearranging the address decoder output to respond to a wider range of dynamic memory addresses. You also change the $\overline{CS}$ signal line going to the 4K set to an additional multiplexed address line going to the 16K set.

It makes sense now, doesn't it?

Closing Comments

Well, there you have it. I have tried to present enough background information to enable you to substitute parts or rearrange logic and control circuits. There is always room for improvement on someone's ideas or techniques, and this construction article is no exception.

You will find many instances when the external memory is unnecessary. Instead of wearing out the keyboard connector merely turn off the power supplies feeding the board.

One word of caution in this area: If you initialize the computer with the external memory energized and, later, remove power to the external circuit, the computer will, in some instances, use the external memory as if it were still available. The result is incorrect operation and/or lost data.

A good way of reserving a block of upper memory for machine-language programs is to power on while the external memory is still off. After the computer is initialized, turn on the external memory power supplies.

The computer won't find the added memory, unless it gets trapped in a loop that asks you the MEMORY SIZE question (Level II).

If you have any questions, I'll be happy to respond but include a SASE. ■

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I was one of the first to buy the HP-35, the MITS Altair, the TRS-80, etc., so naturally here I am with an early TRS-80 Pocket Computer.

The computer can be operated as a calculator or programmed in BASIC.

Its manuel doesn't give much technical information, and though it's rather slow, it's fast enough to be a useful little computer. Incidentally, it's battery powered by mercury cells. No charger. Tandy claims 300 hours on a set of batteries.

Variables for Storage

In addition to standard calculations, you can use variables for storage. This means you don't have to remember what memory number you stashed something in. You have about 200 memories available. As an example, you can enter

```
A=5, B=6, A+5*7AB+SIN(30)/COS(45)< ENTER>
```

The answer is 1055.707107. Incidentally, you enter that formula from the keyboard and type SIN, COS, etc.

You don't have labeled keys for most of the functions as on a regular calculator. It is also possible to recall the formula and make a change in it, either before or after you get an answer. Its editor is primitive, but allows you to insert or delete.

Trig functions work in degrees, radians or grads. Just type the mode you want. Degrees can be in decimal or degrees, minutes and seconds.

One small problem, I noted, was that a radical sign is used for squere root but the computer does not recognize a leading digit. For example, $3\sqrt{8}$ will not give you the cube root of 8. You must instead use 8↑(1/3). This gives the correct result.

The computer uses floating point from E-99 to E99. It displays 10 digits plus the exponent. The liquid crystal display shows 24 characters, but the line can be 80 characters long (including the <ENTER> at the end of the line). You can view any part of a line over 24 characters long at the touch of a key.

The calculator mode allows the four arithmetic operations, power calculations, trigonometric and inverse trigonometric functions, logarithmic and exponential functions, angular conversion (degrees, radians, grads), extraction of the square root, SGN(), ABS(), INT() and logical calculations.

A nice feature is that 18 of the keys can be used to hold functions such as SIN, COS, etc., or even a whole small program or a formula. You are limited to a total of 48 steps. As an example

```
A:1/√(2πFC)
```

This would let you input

```
F=3200,C=.001,<SHIFT> A <ENTER>
```

The answer is 2.230155145E-01. The formula uses ten of the 48 steps you heve available. The : following the A does not take a step. Words like SIN, COS, etc., only use one step.

These reserved keys can be used in the calculator mode or when running BASIC. The machine retains all memory when it is turned off so these reserve key definitions are held until you change or delete them. Tandy provides two clear plastic overlays so you can label your reserved keys.

The 48 steps of memory are not included in your available RAM, so you don't waste any memory if you use this feature.

Programmable

The computer is also programmable in a subset of BASIC. The following instructions are much like those used in Level II BASIC.

INPUT	PRINT	PRINT USING
GOTO	GOSUB	RETURN
FOR	NEXT	IF
THEN	STOP	END
CLEAR	REM	ATN
SIN	COS	TAN
INT	SGN	ABS

Here are some added instructions.

PAUSE	BEEP	DEGREE
RADIAN	GRAD	AREAD
ASN	ACS	LOG
LN	DMS	DEG
EXP		

Some of the commands in the Level II-like group are a bit different. In most cases they are more flexible than Level II equivalents. For example, you can use variables with a number of the instructions that do not allow this in Level II. Permitting you to GOTO or GOSUB to an expression gives you the equivalent of ON . . . GOTO and ON . . . GOSUB. See the sample program for examples.

The CLEAR statement clears all data memory, but you can't reserve string space with it. PRINT USING is rather limited. You use * for AND and + for OR in logic expressions.

Here's a quick rundown of the added instructions.

PAUSE: Like PRINT but only displays the

line for about ¼ of a second.

BEEP: Causes machine to emit a beep sound.

DEGREE: Forces units of an angle input or result to degrees. Used with trig functions.

RADIAN: See DEGREE.

GRAD: See DEGREE.

AREAD: Autometically stores the value of en expression that has been displayed before the progrem is started.

ASN: Inverse of SIN (ARCSIN).

ACS: Inverse of COS (ARCCOS).

LOG: Common log (base 10).

LN: Naturel log (base e).

DMS: Converts decimal degrees to degrees, minutes, seconds.

DEG: Converts degrees, minutes, seconds to decimal degrees.

Now to the direct commands. These are much like Level II BASIC.

RUN	LIST	NEW
CONT	MEM	DEBUG

DEBUG lets you single step through a BASIC program line by line. You can see the line and examine the variables at eny time. I wish the TRS-80 Model I had this command! It is extremely useful.

You may heve noticed that there weren't any string menipuletion instructions in the lists. Unfortunately, that's because there aren't any. You can use string variables, but they will only hold seven characters each. However, to a limited extent, you can concatenate strings.

You can use arrays, both numerical and string, but only with one variable name, A or A$.

Variables' names can consist of only one letter, so you have 26 variables. You cannot use the same letter for a string and numerical variable. Thus when you assign 100 to A, if you put "NAME" in A$, you lose the 100 in A. Also, A$(2) or A(2) is the same memory location es would be used for B or B$. So you ere limited to 26 veriebles whether you store in erreys or single letter variables, numbers or strings. But all is not lost, reed on.

Array Memories

However, you may or may not have another 178 array memories; A(27) or A$(27) to A(204) or A$(204). You share these locations with the program so the number of these additional array memories depends on the program length. You can see how many array memories are available by using the MEM command.

With careful memory management you can put a pretty big program with lots of data in this little computer. With no program loeded you have room for 178 memories (1424 steps). This does not include the 26 variable memories end 48 steps of reserved memory. As an example, with the sample program loaded there ere 77 memories (621 steps) left.

The sample program will calculate the day of the week for any date between the years 1800 and 2000. I don't guarantee its accuracy, but it worked for the dates I tried. It could be streemlined quite a bit by changing the logic of the valid date test routines and using multiple statements on a line. This is just a quick BASIC program to illustrate the Pocket Computer.

The computer operates in four modes. The modes are switched with a single key which steps through them. The present mode is elweys visible on the display.

The RUN mode is used when running a BASIC program or when using the machine es a calculator.

The PRO (PROGRAM) mode is used to enter, LIST, or edit a BASIC program.

The RESERVE mode is used to program the reserve keys.

The final mode, DEF (DEFINE), will take some explaining. You can put e group of programs into the computer and use a label at the beginning of the first line of each program. Then, you can RUN any of the programs with RUN label. The label is any one of the 18 reserved keys. Only one letter in a label. Of course you can also use RUN line number, but a letter might be easier to remember.

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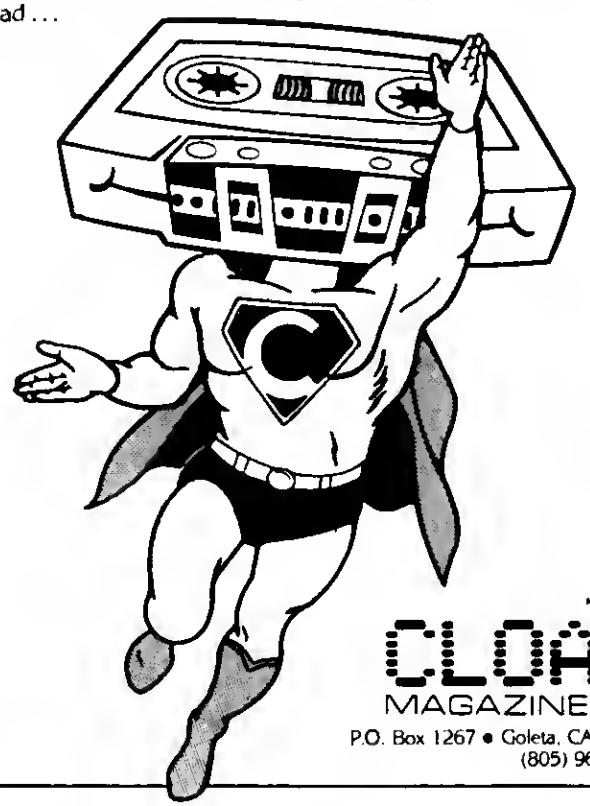

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Labels

A few random comments: There is no random function in the BASIC. However, the manual gives a little formula for non-critical requirements.

You can GOTO or GOSUB to a label. This label is one or several characters in quotes at the beginning of the line.

There is no apostrophe on the keyboard. The computer shuts itself off if not used for about seven minutes. The beep tone is rather high-pitched—my ears are too far gone to hear it.

The line numbers run from 1 to 999. Most commands can be abbreviated, i.e., P. for PRINT, PA. for PAUSE, I. for INPUT, etc. At an error the cursor points to the error position in the line.

A battery powered cassette interface plugs in to the computer. The interface works fine with my old CTR-41. It should work with any similar machine. The interface uses the MIC input jack, not the AUX jack. It took me a few tries to discover this (read the instructions, dummy!).

As with Level II BASIC, CLOAD, CLOAD? and CSAVE are used. Reserved memory is saved separately from the program. You must use a file name (up to seven characters) when loading or saving programs or data files.

You also have a chain statement which will load another program (or module of a large program) under BASIC. I haven't tried this feature yet. I think data memory is preserved, but the manual doesn't mention this.

In addition you have INPUT# and PRINT# to recall and save data files. These instructions are used much like those in Level II BASIC. Note that you won't get an error when recalling data if the data items run out before the designated memory spaces are filled.

All in all I think the Pocket Computer is a well thought out piece of equipment. If you are at all familiar with computers, know the BASIC language and have a little imagination, you can run some fairly elaborate programs with it.■

```
10  PAUSE "PICK A DATE BETWEEN"
20  PAUSE "1800 AND 2000"
30  D=3:INPUT "MONTH (JAN=1) ";A
40  INPUT "DAY ";B
50  INPUT "YEAR ";C
90  IF C>=2000 PRINT "YEAR TOO GREAT":
    GOTO 30
100 IF C<1800 PRINT "YEAR TOO SMALL":
    GOTO 30
110 IF B>31 PRINT "NO SUCH DAY":GOTO 30
120 IF ((A=4)+(A=6)+(A=9)+(A=11))*(B>30)
    THEN 600
125 IF (A=2)*(B>29) THEN 600
130 IF (C/4<>INT(C/4))*(A=2)*(B>28) THEN 600
140 IF (C/100=INT(C/100))*(C/400=INT(C/400))*
    (A=2)*(B>28) THEN 600
150 C=C-1800
160 E=INT(C/4)
170 E=E-INT(C/100)-1
175 IF A>2 THEN 180
178 IF C/4=INT(C/4) LET E=E-1
180 F=C+E
190 GOSUB A+300
200 F=F+G+B
210 D=D+F
215 D=D-7:IF D>6 THEN 215
220 GOTO D+1+500
301 G=0:RETURN
302 G=31:RETURN
303 G=59:RETURN
304 G=90:RETURN
305 G=120:RETURN
306 G=151:RETURN
307 G=181:RETURN
308 G=212:RETURN
309 G=243:RETURN
310 G=273:RETURN
311 G=304:RETURN
312 G=334:RETURN
501 PRINT "SUNDAY":GOTO 570
502 PRINT "MONDAY":GOTO 570
503 PRINT "TUESDAY":GOTO 570
504 PRINT "WEDNESDAY":GOTO 570
505 PRINT "THURSDAY":GOTO 570
506 PRINT "FRIDAY":GOTO 570
507 PRINT "SATURDAY"
570 INPUT "ANOTHER";A$
580 IF A$="YES" THEN 30
590 END
600 PRINT "INVALID DATE, TRY AGAIN":GOTO
    30
```

Sample Program Run

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Keep track of repeating code sections in those expansive programs.

Cross Reference

Erik Camp
372F Nickolson Rd
Fort Sheridan, IL 60037

"I think we can modify this machine language editor/assembler to do what we want, if we can change this section of code."

"What? Will our change affect any other part of the program? Well, I don't know. I'm not sure if this section is used elsewhere."

Does that sound familiar? If so, this cross-reference program will be of interest to you. It allows you to readily determine if a section of code is used by other portions of a program. It also shows what memory locations are used as data storage space for the A and HL registers.

Loading a Cross-reference

This program is written in Level II BASIC and is placed above the editor/assembler in user RAM.

First, load your machine language program using the System Command, then POKE the address into which this cross-reference program (Listing 1) is to be loaded into memory locations 16548 and 16549.

A sample of the printout is shown in Example 1. This particular example is taken from a listing of the locations used by the registers HL and A as data storage locations in Radio Shack's Editor/Assembler.

Column one of this listing is the location address and may indicate a single byte or double byte is reserved.

You can tell if the listing is for a single or double byte just by looking at it.

Column two lists all locations examined which appear to store or load data into either the A register or the HL register pair. In the example shown, the first entry is for decimal location 14308. The next column indicates that location 14308 was addressed by code which resides at decimal location 18106.

The code at 18106 sets the cassette latch address for one cassette device. The machine code also shows that the memory location reserved is a single byte used to store the contents of the A register.

Skipping further into the example, you'll see several locations accessed by ten or more locations in the machine code. The first such location is decimal 16424.

This location is used to store the contents of the HL register pair and therefore reserves two bytes of memory. Location 16424 is used by Radio Shack for the cassette data device control block. That is, location 16424 is the holder for the pointer which addresses the cassette software.

The Program

The first noteworthy item concerning my program is that I have set it up to handle a 70 by 20 array. That is, the program will accept 70 data or entry locations.

While the array size is arbitrary, I have found, at least in regard to the Radio Shack Editor/Assembler program, that no data or entry point location is referenced more than 17 times. While there are some 130 valid entry points used for calls and jumps, memory limitations demanded that I place an arbitrary limit on the maximum array size. Line 470 of the Program Listing insures that the array size is not exceeded.

Line 240 is the entry point for my cross-reference program. The user is asked to provide the locations, as a decimal number, at which the program is to begin and end.

Next, the user is requested to define the start of the 2000 byte memory range which the program is to use as a window. This insures that needless overflows do not occur and speeds the program's operation.

The user is then asked to choose one of two available cross-reference listings. The first option builds an entry point listing for calls and jumps. Using this program option allows a person to see if a program segment is accessed from other areas.

One note of caution, however, this program does not handle relative jumps.

The second option lists the locations which the program uses as data storage locations.

Line 310 searches for code

```
14308  18106
14312  17866  17880  17902
14400  17449
14464  17431
14797  18162
15422  17351
15922  17350
16424  17225  17232  17577  17622  17627
       17634  17645  17673  17678  17760
18109
```

Example 1. Memory Locations used for Data Storage

```
160 REM.  THIS PROGRAM BUILDS CROSS-REFERENCES OF MACHI
    NE LANGUAGE
170 REM.  PROGRAM CALLS AND JUMPS (INCLUDING Z/NZ AND C
    /NC).
180 REM.  THIS PROGRAM WILL ALSO CROSS-REFERENCE DATA L
    OCATIONS
190 REM.  ADDRESSED BY LD REG,(HL)
200 REM.               LD (HL),REG
210 REM.               LD A,(  )
220 REM.               LD (  ),A
230 REM.
240 CLEAR:INPUT "WHERE DO YOU WISH TO START AND STOP";X
    ,X1
250 INPUT "WHAT 2K-BYTE BLOCK DO YOU WISH TO EXAMINE";C
    1:C2=C1+     2000:REM.   LIMITS BUFFER REQUIREMENT
    S
260 INPUT "BUILD CALLS/JUMPS OR DATA LOCATIONS (ENTER 1
     OR 2)";     T: IF T<1 OR T>2 THEN PRINT "ERROR ON
     TYPE ARRAY":GOTO260
270 CLS:X=X-1:DIM C(70,20):     REM.  DETERMINES MAX AR
    EA IN BUF    FER
280 REM.
290 REM.  LETS GO TO WORK....GET A BYTE AND TEST IT
300 REM.
310 IF X=X1 THEN 550 ELSE X=X+1:A=PEEK(X):IF T=1 GOTO 3
    20 ELSE      IF A=34 OR A=42 OR A=58 OR A=58 THEN
    390 ELSE 310
320 IFA<194 OR A>220 THEN 310
330 IF A=194 OR A=195 OR A=196 OR A=202 OR A=205 OR A=2
    04 OR A=     210 OR A=212 OR A=218 OR A=220 THEN 3
    90 ELSE 310
340 REM.
350 REM.  THAT BYTE PASSED THE FIRST TEST.  NOW FOR THE
     SECOND
360 REM.  TEST.  DOES THE VALUE OF THE NEXT TWO BYTES F
    ALL INTO
370 REM.  THE ARRAY WINDOW?  IF SO, PRINT THE LOCATION
    AND....
380 REM.
390 B=PEEK(X+1):C=PEEK(X+2)*256+B:IFC<C1 OR C>C2 THEN 3
    10
400 PRINT X;:Y = 0
410 REM.
420 REM.  ....LOAD THE VALUE AND LOCATION INTO THE ARRA
    Y.
430 REM.
440 IF C < C(Y,0) THEN 700
450 IF C=C(Y,0) THEN FOR Y1 = 1 TO 20: IF C(Y,Y1)=0 THE
    N C(Y,Y1)    =X:GOTO310 ELSE NEXT Y1
460 IF C(Y,1)=0 THEN C(Y,0)=C:C(Y,1)=X:GOTO310
470 Y=Y+1:IF Y < 69 GOTO 440 ELSE PRINT"BUFFER FULL, DR
    OPPING ";    C;" FOUND AT";X:FOR Y1=0TO20:C(70,Y1)
    =0:NEXTY1:GOTO460
480 REM.
490 REM.
500 REM.....
    ........
510 REM.
520 REM.        NOW FOR THE PRINT ROUTINE FOR HARDCOPY
530 REM.
540 REM.
550 CLS:INPUT "TURN ON PRINTER--PRESS 'ENTER KEY' WHEN
    READY";X
560 POKE 16425,0:        REM.  SETS LINE COUNTER TO ZERO
570 FOR X = 0 TO 69:LPRINT C(X,0);:FOR Y = 1 TO 20
580 IF C(X,Y)<>0THENLPRINTC(X,Y);
590 NEXT Y:LPRINT:IF C(X+1,0)<>0 THEN NEXTX:GOTO240 ELS
    E 240
600 REM.  AND START ALL OVER AGAIN.....
610 REM.....
    ........
620 REM.
630 REM.
640 REM.
650 REM.        THIS SECTION PHYSICALLY MOVES THE ARRAY
    ELEMENTS
660 REM.         FIRST WE SAVE TIME BY SKIPPING THE END
    ELEMENTS
670 REM.          THAT HAVE NO DATA.....
680 REM.
690 REM.
700 Y2=69:PRINT:PRINT"MUST RE-ORDER THE ARRAY";
710 IF C(Y2,0)=0 THEN Y2=Y2-1:GOTO710
720 Y2=Y2+1:       REM.....AHEAD POINTER
730 Y3=Y2-1:GOSUB 780:Y2=Y3:IF Y2=Y THEN CLS: PRINT " .
    ..DONE":     GOSUB 830:GOTO460 ELSE 730
740 REM.
750 REM.  THIS CODE MOVES ONE LINE OF THE ARRAY UP
760 REM.  AND CLEARS THAT LINE
770 REM.
780 FOR Y1=0TO20:C(Y2,Y1)=C(Y3,Y1):C(Y3,Y1)=0:NEXT Y1:R
    ETURN
790 REM.
800 REM.  THIS GIVES THE OPERATOR SOMETHING TO READ WHI
    LE
810 REM.  THE PROGRAM IS WORKING.
820 REM.
830 FOR X3=0TO70:PRINTC(X3,0);:NEXT:PRINT:RETURN
```

Program Listing

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that equals a register save to memory or a load register from memory for the A and HL registers. Lines 320 and 330 seek code that relate to jumps and calls.

When a match is found, the program proceeds to line 390 where it determines the decimal value of the two bytes following a match. Line 390 also insures that the value is within an acceptable range. This test helps to keep the array size within limits. The test also allows me to ignore those values which are obviously not correct.

Because this program's logic is relatively limited, erroneous entries can still occur. Errors may occur because ASCII tables or other constants are treated as legal program text. Thus, line 390 ignores those entries which claim to use ROM memory (memory below 14000 decimal in the TRS-80) or program buffer memory. (Program buffer memory, for example, in the Radio Shack Editor/Assembler exists above 23803.) These limits must be set according to the requirements of the user.

Line 440 insures that the lowest value begins the array. If the array has a starting value greater than the present value, the program jumps to line 700. The code which starts at line 700 rearranges all of the array upward to make room for the newest entry.

Note that the highest value may be lost unless line 390 is used to limit the range of values acceptable at this point.

Line 450 checks for a match within the array. If the present value matches, the memory locations are entered into the table in the next free column location. If there is no match, the program transfers to line 460 which seeks the next unused row. If the row is not empty, then the row pointer is incremented and the program loops back to line 440. This continues until the maximum size of the array (70 entries) is reached.

Lines 550 through 590 handle the output of the array to the line printer. In order to speed printing, only those array cells which have nonzero values are printed. All other cells are ignored. The program loops back to the beginning when the information within the array has been printed out.

Conclusion

As mentioned earlier, the logic used within this program is limited. The user must therefore be aware that the information provided in the listing must be viewed critically and not automatically accepted as authoritative. Nevertheless, I have found this program to be extremely helpful in my attempts to learn more about the inner workings of Radio Shack's Editor/Assembler. ■

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When I had finally saved up enough money for a disk drive for my TRS-80, I only had 16K of RAM. Radio Shack says in the manual that you can operate TRSDOS with 16K, but when you load BASIC it turns out you've only got about 6K. That's not much for a program.

Worse, TRSDOS and its friends and relatives do a darn good job of filling up the disk sitting in that lonely drive.

Well, here is one application I found that requires only small files, a little memory, and holds just about everybody's interest—the personal calendar. This simple program automates those little notepads that everybody carries around with "what I have to do today" information on them.

Designing the Program

A calendar program is an ideal candidate for using random access file. Think about it. You never know when you might want to add a note for September 17, July 8 or February 10.

Then we'll need a separate record for each day—oops—there are 365 days in a year, and we can only have 335 random access records on an entire disk.

Fortunately, a year can be divided in other ways. Weeks are a convenient division for our purposes. Fifty-two records are easy to menage in the space available and we won't spend a lot of time reading, writing and searching, as we would if we had one record for each month. (Actually it turns out we'll need 53 records: Seven days times 52 weeks is only 364.)

Each record holds 255 bytes. As the TRSDOS manual says, that's a lot of data. My guess is that one's average note probably won't contain more than ten words, say 50 or 60 characters. That means that it should be possible to pack four or five seperate notes into each physical record.

Unfortunately, most people do more than four or five things each week.

The solution to this last problem lies in the way random access files are handled by TRSDOS. Remember that at first the file contains 53 records, one for each week plus the extra day or two at the end of the year. When one of these records is filled up all we have to do is find the next empty space on the disk, some record between 54 and 335, save its number in the filled record and start filling this new one. (When we design the record layout, we'll leave a space for just this purpose.) If this seems confusing, a look at Fig. 1 may help clarify things.

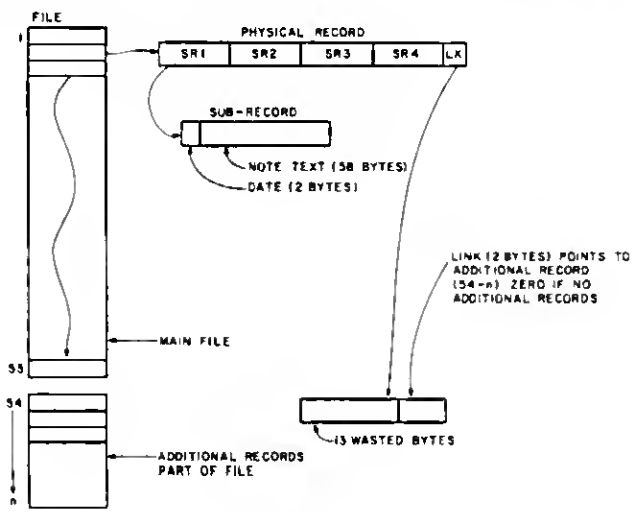

Figure 1.

Let's design a record for this personal calendar file. If it's unlikely that any given note will take more than 50 or 60 characters, the simplest way to design our records is to divide them into 60-byte fields (or subrecords). That leaves 15 bytes.

We'll use two bytes for the pointer to the next record and just ignore the remaining 13. This pointer will be set to zero if the record isn't full. (See Fig. 1.)

We could make even more efficient use of disk space by using variable length subrecords, but that can get tricky to program and even harder to ex-

```
1330 PRINT@271,"EACH NOTE IS ENDED WITH AN 'ENTER'."
1340 PRINT@332,"A SECOND ENTER WRITES THE NOTES TO DISK
     ."
1350 PRINT@450,"<";STRING$(58,"-");">"
1360 L%=512:FORI%=1TO8:PRINT@L%,RIGHT$(STR$(I%),1);".";
     :L%=L%+64:NEXTI%
1365 REM *** ACTUAL EDITOR STARTS HERE
1370 CU%=15874:LS%=CU%
1380 FORZZ%=1TO25:NEXTZZ%:POKECU%,95
1390 K$=INKEY$
1391 IFK$=""THENK=0ELSEK=1
1392 POKECU%,32
1393 IFK<>0THEN GOTO1395
1394 GOTO1380
1395 K=ASC(K$)
1396 REM *** 13 IS THE ENTER KEY AND 8 IS THE BACK ARRO
     N
1400 IF K=13 THEN GOTO 1460
1410 IFK=8THEN GOTO 1492
1420 POKE CU%,K:CU%=CU%+1
1430 IF CU%<=LS%+60 THEN GOTO 1380
1440 GOTO1470
1445 REM *** A BYTE WITH 128 MARKS THE END OF TEXT
1460 POKECU%,128:IFCU%=LS%THEN GOTO 1500
1470 CU%=LS%+64:LS%=CU%
1480 IFCU%>16383 THEN GOTO 1500
1490 GOTO 1380
1492 IFCU%=LS%THEN GOTO 1380
1494 CU%=CU%-1:GOTO1380
1500 REM *** OPEN THE FILE AND WRITE 'EM OUT
1510 GOSUB51000
1520 LS%=15874:FIELD 1,60 AS F$(1), 60 AS F$(2), 60 AS
     F$(3), 60 AS F$(4), 13 AS R$, 2 AS LK$
1525 REM *** LOOP BELOW FINDS THE FIRST RECORD FOR THIS
      WEEK
1526 REM *** THAT HAS SOME SPACE AVAILABLE.
1530 GET 1,WK%: LK%=CVI(LK$)
1540 IF LK%=0 THEN GOTO 1560
1550 WK%=LK%:GOTO 1530
1555 REM *** NOW WE LOOK FOR THE EMPTY SPOT ON THIS REC
     ORD
1560 FORI%=1TO4
1570 IF ASC(F$(I%))<>32THEN GOTO 1590
1580 R%=I%:I%=5
1590 NEXT
1595 REM *** START PUTTING TEXT IN THE RECORD
1600 IF PEEK(LB%)=128 THEN GOTO 1710
1610 IF LS%>16383THEN GOTO 1710
1620 L$="":FORI%=LS%TOLS%+59
1630 L$=L$+CHR$(PEEK(I%)):NEXTI%
1640 L$=MKI$(DD%)+L$
1650 LSET F$(R%)=L$:R%=R%+1:LS%=LS%+64
1660 IF R%<5 THEN GOTO 1600
1665 REM *** ONCE A RECORD IS FULL WE FIND THE NEXT AVA
     ILABLE
1666 REM *** RECORD (WITH THE LOF FUNCTION) FILL IN THE
      LINK
1667 REM *** AND WRITE OUT THE OLD ONE. THEN WE GET THE
      VIRGIN
1668 REM *** RECORD AND CLEAN IT UP FOR THE CODE ABOVE.
1670 LK%=LOF(1)+1:LSETLK$=MKI$(LK%)
1680 PUT 1,WK%:WK%=LK%:GET 1,WK%:LSET LX$=MKI$(0)
1690 FORI%=1TO4:LSET F$(I%)=STRING$(60," "):NEXT I%
1700 R%=1:GOTO1600
1701 REM *** ALL DONE.
1710 PUT 1,WK%:CLOSE:GOTO1000
4000 REM *** THIS SECTION HANDLES DISPLAYING THE NOTES
     FOR
4010 REM *** THE CURRENT DATE. IT JUST READS RECORDS ST
     ARTING
4020 REM *** WITH THE CURRENT WEEK'S AND SCANS FOR A DA
     TE MATCH
4030 REM *** WHEN IT FINDS ONE THAT NOTE IS DISPLAYED O
     N THE
4040 REM *** SCREEN (NICELY CENTERED BY THE WAY).  YOU
     CAN
4050 REM *** ONLY HAVE 13 NOTES FOR A GIVEN DAY AS A RE
     SULT OF
4060 REM *** THIS CODE.  (THE ONLY MAJOR LIMITATION IN
     THE
4070 REM *** SYSTEM).
5000 CLS:GOSUB51000:CLS:CU%=128:PRINT@22,"NOTES FOR: ";
     DT$
5010 FIELD 1,60 AS F$(1),60 AS F$(2), 60 AS F$(3), 60 A
     S F$(4), 13 AS R$, 2 AS LK$
5015 GET 1,WK%
5016 REM *** IF THE FIRST BYTE IS BLANK NO NOTES FOR TO
     DAY
5020 IF LEFT$(F$(1),1)=" "THEN GOTO 5080
5025 REM *** BELOW WE SCAN FOR A DATE MATCH
5026 REM *** CODE AT 6000 HANDLES PRINTING.
5030 FOR I%=1TO 4
5040 IF CVI(LEFT$(F$(I%),2))=DD% THEN GOSUB 6000
5050 NEXT I%
5055 REM *** CHECK TO SEE IF THERE ARE MORE RECORDS OR
5056 REM *** WAIT FOR A KEYPRESS WHILE HE READS THE NOT
     ES.
5060 LK%=CVI(LK$):IF LK%=0 THEN GOTO 5080
5070 WK%=LK%:GOTO5015
5080 CLOSE:PRINT @ 980,"PRESS ANY KEY TO CONTINUE";
```

program continues

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plain.

One more problem: Since each week has one or more records, and people usually think in terms of days, there has to be some way of identifying which notes to print on any given day. This is easy enough to arrange. We'll just stick the day of the month onto the front end of each subrecord. It takes only two bytes, leaving 58 characters for the actual notes.

You can see that the design of the file dictates how the program will operate: what information is required, what routines it will need, etc. It even tells us that we will need two programs.

When you're using random-access files the computer doesn't know whether or not a given record exists. If you tell it to get record 97 it will do just that and then give you whatever happens to be at that spot on the disk. We'll have to write a program to initialize the calendar file.

Program Listing 1 is that program. It creates the file and writes out 53 blank records with zero as the forward pointer in each one. The main program will know if a given record has anything in it, and, if it does, where to find the next record.

Human Engineering

As you look over these two programs, (especially the INIT/BAS code) you'll notice an abundance of code that does nothing but print messages. That's one aspect of something called human engineering—making programs that are easy to use, idiot-proof.

We've all seen programs that require several pages of explanation before you can even begin to use them. (Some of them (gasp!) in these very pages.)

These two programs are a beginner's attempt to write programs that are easy to use and hard to blow up.

Program Listing 2, called CALEN/BAS, handles all the actual work that has to be done. To

```
100 CLEAR 500
110 DIM NO%(12),F$(4)
115 GOSUB50000
116 GOSUB50040:CLS: REM *** NEEDED TO RESET WK% WHEN EX
    TRA RECORDS ARE USED
117 REM *** FOLLOWING IS THE MAIN MENU HANDLER
130 PRINT @ 23,"PERSONAL CALENDAR"
140 PRINT @ 212,"1. ADD NEW NOTES"
150 PRINT @ 276,"2. DISPLAY TODAY'S NOTES"
160 PRINT @ 340,"3. RETURN TO TRSDOS"
170 PRINT @ 473,"SELECT 1,2,3"
180 K$=INKEY$:IF K$="" THEN GOTO 180
190 K%=VAL(K$): ON K% GOTO 1000,5000,210
195 REM *** RETURN TO TRS-DOS
200 GOTO100
210 CLOSE:CMD"S"
1000 REM *** CODE BELOW HANDLES ALL FILE ADDITIONS
1010 CLS:PRINT @ 17,"PERSONAL CALENDAR FILE UPDATE"
1020 PRINT @ 92,DT$
1030 PRINT @ 217,"1. CHANGE DATE"
1040 PRINT @ 281,"2. ADD NOTE"
1050 PRINT @ 345,"3. MAIN MENU"
1060 PRINT @ 474,"SELECT 1,2,3"
1070 K$=INKEY$:IFK$=""THENGOTO1070
1080 K=VAL(K$):ON K GOTO 1200,1300,1180
1090 GOTO1070
1091 REM *** BACK TO THE MAIN MENU CODE BELOW
1100 CLOSE:CLS:GOTO116
1110 REM *** THIS SETS A NEW DATE SO YOU CAN ADD STUFF
     FOR THE
1111 REM *** FUTURE. OTE EXTRA ENTRY POINT INTO INITIAL
     ISATION
1112 REM *** ROUTINE (50140) TO SET WK% AND DD% ETC.
1200 CLS:PRINT@468,"ENTER NEW DATE";:INPUTDT$:GOSUB5014
     0
1210 GOTO1000
1300 REM *** CODE BELOW HANDLES ADDITIONS TO FILE
1301 REM ***
1302 REM *** FIRST SECTION HERE IS A SIMPLE EDITOR.
1303 REM *** THE ONLY CONTROLS ARE THE BACK ARROW AND
1304 REM *** 'ENTER'.
1310 CLS:PRINT @ 25,"NEW NOTE INPUT":PRINT @ 92,DT$
1320 PRINT@200,"YOU MAY ENTER UP TO 8 NOTES FOR THE DAT
     E ABOVE."
```

program continues

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```
5090 K$=INKEY$:IF K$<>""THEN GOTO116ELSEGOTO5090
5091 REM *** CODE BELOW HANDLES CENTERING AND PRINTING
     OF NOTES
6000 L$=""
6001 FORJ%=3TO60
6002 K$=MID$(F$(I%),J%,1):K%=ASC(K$)
6010 IFK%<>120THEN GOTO6030
6020 L%=J%-1:J%=61
6030 NEXT J%
6040 L$=LEFT$(F$(I%),L%)
6050 PRINT@CU%+((64-LEN(L$))/2),L$;
6060 CU%=CU%+64:RETURN
50000 REM *** BASIC INITIALISATION
50010 FORI%=1TO12:READMO%(I%):NEXTI%
50020 DT$=LEFT$(TIME$,8)
50030 IF LEFT$(DT$,2)="00" THEN GOTO 50120
50040 MM%=VAL(LEFT$(DT$,2))
50050 DD%=VAL(MID$(DT$,4,2))
50060 YY%=VAL(MID$(DT$,7,2))
50070 YY%=YY%+1900
50075 REM *** BEWARE ***  THIS WILL SCREW UP IN A FEW Y
     EARS
50080 IF INT(YY%/4) = YY%/4 THEN MO%(2)=29 ELSE MO%(2)=
     28
50090 WK%=0: FORI%=1TO MM%-1: WK%=WK%+MO%(I%): NEXTI%
50100 IF MM%=1 THEN WK%=0
50105 WK%=WK%+DD%-1:WK%=INT(WK%/7)+1
50110 RETURN
50120 CLS:PRINT @ 12,"DATE NOT VALID, ENTER DATE (MM/DD
     /YY)"
50130 PRINT @ 90," ";:INPUT DT$
50135 REM *** SECOND ENTRY TO THIS ROUTINE TO FIX UP WK
     % WHEN
50136 REM *** EXTRA RECORDS ARE USED.
50140 IF LEN(DT$)<>8 THEN GOTO 50120
50150 GOTO 50040
51000 REM *** FILE OPEN ROUTINE
51010 IF PW$<>"" THEN GOTO 51040
51020 PRINT@409,"ENTER PASSWORD ";
51030 INPUTPW$:IFPW$<>""THEN PW$="."+PW$
51040 OPEN "R",1,"CALEN/DAT"+PW$
51050 RETURN
60000 REM *** DATA BELOW IS FOR STANDARD YEAR.
60005 REM *** LEAP YEARS ARE HANDLED IN LOGIC.
60010 DATA 31,28,31,30,31,30,31,31,30,31,30,31
```

Program Listing 1. Initialization.

do its job CALEN/BAS must perform several major tasks. First, it needs to figure out what week it is. BASIC INITIALIZATION handles this beginning at line 50000.

I have used the simple "divide by 4" test for leap years. Though it won't come up for some time, this will eventually cause an error. (If anyone can supply the correct leap year algorithm, I will be more than happy to incorporate it and publish the correction.)

To add new notes to a file, the program must be able to determine if the appropriate physical record is full, and if it is, find a new record and then add the notes. All this is taken care of in lines 1500 through 1710. If you are not conversant with random access techniques, this is the place to look for an example. Notice that if it is necessary to fetch an additional record, the variable WK% (ordinarily the week number) is subverted—it contains the number of the new record.

Reading and displaying the notes for any given day is the third major function of the program. This is quite straightforward. Beginning with line 5000 the program simply opens the file and starts to read records beginning with the current week. It checks each of the four subrecords to see if the day of the month in the first two bytes matches today's date, and if so, prints out the note.

If the forward pointer in the last two bytes of the record is not zero, the program gets that record and again checks through the notes. When it has found all the notes for the current data, it closes the file and waits for a keypress to return to the main menu.

Conclusion

As you can see, it is possible to do some practical work with a single disk, 16K TRS-80. The techniques I've used apply not just to calendar keeping but to any type of low volume archival storage. For example, you might want to divide a file not by weeks but by budget classes:

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Finally, there is room in the program for considerable customization. If you own a printer, you can print out the day's notes and check things off as you do them. You can use disk spece more efficiently with variable length subrecords. You can improve the editor used to enter notes so that you can correct a mistake after leaving a line.

Most importantly, get busy and use that computer!■

```
100 CLEAR 500
110 CLS
120 PRINT @ 20,"INITIALISE CALENDAR FILE"
130 PRINT @ 136,"WHAT DRIVE NILL HOLD THE CALENDAR DISK
    (0-3)";:INPUT D%
135 IF (D%>3) OR (D%<0) THEN GOTO 110
140 PRINT@195,"DO YOU NANT TO PASSWORD PROTECT THE CALE
    NDAR FILE (Y OR N)?"
150 K$=INKEY$
160 IF K$="N" TNEN GOTO 240
170 IF K$="Y" THEN GOTO 190
180 GOTO 150
190 PRINT @ 268,"ENTER A PASSWORD (6 CHARACTERS OR LESS
    )"
200 PRINT @ 348," ";: INPUT PW$
210 IF LEN(PW$) <= 6 THEN GOTO 240
220 PW$=LEFT$(PW$,6)
230 PRINT @ 401,"PASSWORD TRUNCATED TO: ";PW$
240 PRINT @ 515,"PLACE THE CALENDAR FILE DISK IN DRIVE
    ";D%;" AND PRESS ENTER."
250 K$=INKEY$:IF K$="" THEN GOTO 250
260 REN *** FOLLOWING CODE SETS UP THE FILE NAME
270 IF LEN(PW$)>0 THEN PW$="."+PW$
280 F$="CALEN/DAT"+PW$+":"+RIGHT$(STR$(D%),1)
290 REM *** FOLLOWING CODE OPENS AND INITIALISES CALEND
    AR FILE
300 OPEN "R",1,F$
310 FIELD 1,1 AS T$,252 AS D$,2 AS C$
320 LSET T$=" "
330 LSET C$=MKI$(0)
340 LSET D$=STRING$(252," ")
350 FOR I=1 TO 53
355   PRINT @ 599,"INITIALISING NEEK ";I
360   PUT 1,I
370 NEXT I
380 CLOSE
390 PRINT @ 724,"INITIALISATION COMPLETE"
395 FOR I=1 TO 1000:NEXT I
400 CMD"S"
410 END
```

Program Listing 2. The Personal Calendar.

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- COMPLETE MANUAL AND DOCUMENTATION ACCOMPANY EACH MANUAL
- MINIMUM SYSTEM REQUIREMENTS - 2 DISK DRIVES FOR MODEL I...1-DISK DRIVE FOR MODEL II

ACCOUNTS PAYABLE

The accounts payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. In addition, it produces cash management reports. This system aids in tight financial control over all cash disbursements of the business. Several reports are available and supply information needed for the analysis of payments, expenses, purchases and cash requirements. All A/P data feeds General Ledger so that data is entered into the system just once. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding many larger systems.

CAPABILITIES

- ★ menu driven; easy to use; full screen prompting and cursor control
- ★ invoice oriented; everything revolves around the invoice; handles new invoice or credit memo or debit memo
- ★ invoice information recorded; invoice #, description, buyer, check register #, invoice date, ege date, amount of invoice, discount (in %), freight, tax ($), total payable
- ★ transaction print and file maintenance procedures insure accuracy
- ★ flexible check calculation procedure; allows checks to be calculated for a set of vendors - or - for specific vendors
- ★ program prints your checks; contiguous computer checks with your company letterhead can be purchased from SBSG
- ★ reports include (samples on back):
  - open item listing/closed item listing - both detail and summary
  - debit memo listing/credit memo listing
  - aging
  - check register report (to give an audit trail of checks printed)
  - vendor listing and vendor activity (activity of the whole year)
- ★ fully linked to GENERAL LEDGER; each invoice can be distributed to as many as five (5) different GL accounts; sysem automatically posts to cash and A/P accounts

ACCOUNTS RECEIVABLE

The objective of a computerized A/R system is to prepare accurate and timeley monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. The programs composing this system were developed 5 years ago, especially for small businesses using the Wang Microcomputer. They have been tested in many environments since then. Each module can be used stand alone or can feed General Ledger for a fully integrated system.

CAPABILITIES

- ★ menu driven; easy to use; full screen prompting and cursor control
- ★ invoice oriented; invoices can be entered before ready for billing, when ready for billing, after billing or after paid
- ★ allows entry of new invoice, credit memo, debit memo, or change/delete invoice
- ★ allows for progress payment
- ★ transaction information includes:
  - type of A/R transaction
  - customer P.O. #
  - description of P.O.
  - billing date
  - general ledger account number
  - invoice amount
  - shipping/transportation charges
  - tax charges
  - payment
  - progress payment information
  - transaction print and file maintenance procedures insure accuracy
- ★ customer statements printed; computer statements with your company letterhead can be purchased from SBSG
- ★ reports include; (samples on back)
  - listing of invoices not yet billed
  - open items (unpaid invoices)
  - closed items (paid invoices)
  - aging
- ★ fully linked to General Ledger; will post to applicable accounts: debits A/R, credits account you specify

PAYROLL

Payroll involves many complex calculations and the production of reports and documents, many of which are required by government agencies. It is an ideal candidate for the computer. With this Payroll system in-house, you can promptly and accurately pay your employees and generate accruate documents/reports to management, employees, and appropriate government agencies concerning earnings, taxes, and other deductions. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- ★ performs all necessary payroll tasks including:
  - file maintenance, pay data entry and verification
  - computation of pay and deduction amounts
  - printing of reports and checks
- ★ can handle salaried and hourly employees
- ★ employees can receive:
  - hourly or salary wage
  - vacation pay
  - holiday pay
  - piecework pay
  - overtime pay

(Continued on next page)

(PAYROLL CAPABILITIES CONTINUED)

- ★ employees can be paid using any combination of pay types (except, hourly cannot receive salary & salary cannot receive hourly)
- ★ special non-taxable or taxable lump sums can be paid regularly or one time (bonus, reimbursements, etc)
- ★ health & welfare deductions can be automatically calculated for each employee
- ★ earnings-to-date are accumulated and added to permanent records; taxes are computed and deducted US income tax, Social Security tax, state income tax, other deductions (regular or one time)
- ★ paychecks are printed, computer checks with your company letterhead can be purchased from SBSG
- ★ calculations are accumulated for; employee pay history, 941A report, W-2 report, insurance report, absentee report
- ★ fully linked to General Ledger Each employee's payroll information can be distributed to as many as (12) twelve different GL accounts, system automatically posts to cash account

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GENERAL LEDGER

The General Ledger accounting system consolidates financial data from other accounting subsystems (A/R, A/P, Payroll, direct posting) in an accurate and timely manner. Major reports include the Income Statement and Balance Sheet and a "special" report designed by management. The beauty of this General Ledger system is that it is completely user formatted. You "customize" the account numbers, descriptions, and report formats to suit your particular business raquirements. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceading) many larger systems.

CAPABILITIES

- ★ more than 200 chart of accounts can be handled
- ★ account number structure is user defined and controlled
- ★ more then 1,750 transactions may be entered via
  - direct posting; done by hand; validated against the account file before acceptance
  - external posting; generated by A/R, A/P, Payroll or any other user source
- ★ data is maintained and reported by:
  - month
  - quarter
  - year
  - previous three quarters
- ★ reports (samples on back) include:
  - trial balances
  - income statement
  - balance sheet
  - special accounts reports and more . . .
- ★ user formats reports with the following designed as you wish:
  - titles
  - headings
  - account numbers
  - descriptions
  - subtotals
  - totals
  - skip lines
  - skip pages
- ★ up to eight levels of totals - fully user designated
- ★ menu driven; easy to use; full screen prompting and cursor control

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17. PRESENT VALUE OF A FUTURE AMOUNT
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19. RATE OF RETURN-CONSTANT INFLOW
20. REGULAR WITHDRAWAL FROM INVESTMENT
21. STRAIGHT LINE DEPRECIATION
22. SUM OF DIGITS DEPRECIATION
23. DECLINING BALANCE DEPRECIATION
24. BREAK EVEN ANALYSIS
25. SALVAGE VALUE OF INVESTMENT
26. PAYMENT ON A LOAN
27. FUTURE SALES PROJECTIONS
28. CREDIT CARD FILE
29. ECONOMIC ORDER QUANTITY (EOQ) INVENTORY MODEL
30. VALUE OF HOUSE CONTENTS
31. TEXT EDITOR
32. MONTHLY CALENDAR
33. DAY OF WEEK
34. CASH FLOW VS. DEPRECIATION
35. COMPLETE MAIL SYSTEM
36. INTEREST RATE ON A LEASE

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THE HORSE SELECTOR II (FLATS) (By Dr. Hal Davis **$50.00**
New simplified version of the original Horse Selector. The first Horse Selection System to actually calculate the estimated odds of each horse.
HIGHER PROFITS (OVER 100%) POSSIBLE THROUGH SELECTIVE BETTING ON:
- Rates each horse in 10 seconds.
- Easy to follow rules.
- Can be used with any Apple II Computer.
- 100% money back guarantee (returned for any reason).
- Uses 4 factors (speed rating, track variant, distance of the present race, distance of the last race).
- Using the above factors, the Horse Selector calculates the estimated odds. BET on horses whose actual payoff (from the Tote Board or Morning Lines) is higher than payoff based on estimated odds.
- Using the above factors, the Horse Selector calculates the estimated odds. BET on any selected horse with an estimated payoff (based on Tote Board or Morning Lines) higher than calculated payoff (based on Horse Selector II).
- Source listing for the TRS-80™, TI-59, HP-67, HP-41, Apple and BASIC Computers.
- No computer or calculator necessary (although a calculator would be helpful for the simple division used to calculate estimated odds).

FREE Dutching Tables allows betting on 2 or more horses with a guaranteed profit.

NEWDOS/80

A **New** enhanced NEWDOS for TRS-80™ Model I for the 1980's

Apparat Inc., announces the most powerful Disk Operating System for the TRS-80™. It has been designed for the sophisticated user and professional programmer who demands the ultimate in disk operating systems.

NEWDOS/80 is not meant to replace the present version of NEWDOS 2. 1 which satisfies most users, but is a carefully planned upward enhancement, which significantly extends NEWDOS 2. 1's capabilities. This new member to the Apparat NEWDOS' family is upward compatible with present NEWDOS 2. 1 and is supplied on Diskette, complete with enhanced NEWDOS + utility programs and documentation. Some of the NEWDOS/80 features are:
- New BASIC commands that supports with variable record lengths up to 4095 Bytes long.
- New BASIC commands that supports with variable record lengths up to 4095 Bytes long.
- Mix or match disk drives. Supports any track count from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for BASIC or machine code application programs. User never sees "DOSREADY" or "READY" and is unable to "BREAK", clear screen, or issue any direct BASIC statement including "LIST."
- New editing commands that allow program lines to be deleted from one location and moved to another or to allow the duplication of a program line with the deletion of the original.
- Enhanced and improved RENUMBER that allows relocation of subroutines.
- Powerful program chaining.
- Device hanging for routing to display and printer simultaneously.
- CDE function; simultaneous striking of the C, D and E keys will allow user to enter a mini-DOS to perform some DOS commands without disturbing the resident program.
- Upward compatible with NEWDOS 2. 1 and TRSDOS 2.3.
- Includes Superzap 3.0 and all Apparat 2.1 utilities.

..... **$149.00**

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Galactic Software Ltd.

CASSETTE VERSION **$89.00**
DISK VERSION **$99.00**

1. The system is designed for the active "trader" not the "long term" investor, as the system is "technically" oriented.
2. For the TRS-80™ Model I, Level II, 16K or more. Available in both disk and tape versions.
3. Tracks user selected issues, in a technical system that reflects the issue's performance against the overall market.
4. Set up data is input by the user from the Standard and Poors stock guide or Value Line.
5. Daily issue data, "high", "low", "close" and "volume" are input from any newspaper containing this information.
6. Daily overall market, "volume" and "closing Dow" are also provided from a newspaper.
7. Volume and price changes of an issue, as they compare to volume an price changes of the overall market, are the basis of this system's analysis of the given issue.
8. Comparisons of the issue against itself are also done. This may allow the user to spot "unusual" activity on this issue.
9. Clear indications are given as to whether the issue is "out performing", "under performing" or "performing" with the market.
10. Complete video and printed output is provided.
11. This program is intended to be a guide to indications, and is not to be used as a sole recommendation to buy, sell or hold an issue. These decisions are the responsibility of the user and his brokerage.

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Inventory Control.....Payroll.....Bookkeeping System.....Stock Calculations.....
Checkbook Maintenance.....Accounts Receivable.....Accounts Payable.....

BUSINESS 100 PROGRAM LIST

1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNU1	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
NAME		**DESCRIPTION**
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCONVBD	Investor's rate of return on convertable bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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COMPUTRONICS Announces ...MOD-II

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- Tips for running your Model II
- Latest announcements and updates

The Newsletter For Owners Of The TRS-80™* MODEL II MICROCOMPUTER

SPECIAL CHARTER SUBSCRIPTION RATE $12.00 □ (For 12 issues)

MOD-II PROGRAMS CURRENTLY AVAILABLE

(1) **ELECTRIC PENCIL** (Michael Shrayar Software).....Complete word processor with extensive editing and printar formatting features.....$275 (STANDARD CP/M VERSION).....$300 (DIABLO, NEC OR OUME CP/M VERSION).....$325 (STANDARD TRSDOS VERSION).....$350 (DIABLO, NEC OR OUME TRSDOS VERSION).

(2) **GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, INVENTORY CONTROL AND PAYROLL** (Small Business Systems Group).....works under TRSDOS.....can be used one module at a time or as a coordinated system.....$225 per module.....$995 for the complete system.

(3) **GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, INVENTORY CONTROL AND PAYROLL** (Peachtree Software).....requires CP/M and MICROSOFT BASIC.....professional business systems.....turn key operation.....discounts available.....$1000 per module .....$5000 for the complete system.

(4) **SELECTOR III** (Micro-Ap).....complete data management system.....user defined fields and codes.....manages any list defined by the user..... includes additional modules for simplified inventory control, accounts receivable and accounts payable.....requires CBASIC-2 and CP/M .....$295.

(5) **GLECTOR** (Micro-Ap).....add on package to the SELECTOR III.....general ledger that allows the user to define a customized chart of accounts.....$250.

(6) **GSF** (Racet Computers).....Ganaralized Subroutine Facility.....a series of super fast machine language utilities that can be called from a BASIC program (no machine language knowledge required).....sorts 1000 items in under 5 seconds.....allows PEEK and POKE statements..... move data blocks.....compress and uncompress data.....works under TRSDOS.....$50.

(7) **DSM** (Racet Computes).....Disk Sort Merge.....sorts and merges large multiple diskette files on a 1 to 4 drive system.....NOT AN IN MEMORY SORT.....can actually alphabetize (or any other type or sort) 4 disk drives worth of data.....sorts one complete disk of information in 10 minutes.....information is provided to use DSM with the RS MAILING PROGRAM.....works under TRSDOS.....$150.

(8) **RSM** (Small Systems Software).....a machine language monitor and disassembler.....can be used to see and modify memory or disk sectors.... conteins all the commands found on the Model-I version plus some additional commands for the MOD-II.....works under TRSDOS.....$39.95.

(9) **CP/M** (Lifeboat Associates).....an alternative operating system to TRSDOS that allows users to use hundreds of programs currently available to CP/M owners.....This is the only version of CP/M for the MOD-II that comes with an elemantary CP/M guide written especially for MOD-II owners.....$170.

(10) **MICROSOFT BASIC** (Microsoft).....an enhanced version of the MICROSOFT BASIC found on TRSDOS.....works under CP/M.....adds commands such as chaining (allows the user to LOAD and RUN a new program without losing the variables currently in memory).....long variable length file records, WHILE/WEND and others.....can be used with the BASIC COMPILER to speed up programs (3-10 times faster execution).....$350.

(11) **CBASIC-2**.....a non-interactive BASIC used for many programs that run under CP/M.....requires CP/M.....allows user to make more efficient use of disk files.....eliminates the use of the most line number reference.....required for programs such as SELECTOR and GLECTOR...$120.

(12) **MAILING ADDRESS** (Peachtree Software).....requires CP/M.....keeps track of name and address information and allows the selective printing of the information in the form of mailing lists or address labels.....unique key structure and formatting structure allows for a multitude of retrieval alternatives.....$790.

(13) **PROPERTY MANAGEMENT** (Peachtree Software).....requires CP/M.....keeps track of all financial records related to property management .....$1500.

(14) **FORTRAN-80** (Microsoft).....ANSI 66 (except for COMPLEX) plus many extensions.....requires CP/M.....$425.

(15) **N & E COMPUTRONICS, INC. SHARE-A-PROGRAM DISKETTE #1**.....works under TRSDOS.....a collection of programs written by MOD-II owners.....programs include date base menegement.....a word processor.....mail system.....mortgage calculations.....checkbook registar..... and many others.....$8 (add $3 postage outside of the United States, Canada and Mexico).....FREE if you send us a diskette containing a program that can be added to the SHARE-A-PROGRAM DISKETTE.

(16) **MEMOREX OR WABASH CERTIFIED DISKETTES**.....$49.95 (per box of 10).

(17) **FLEXI-MATIC DISKETTE STORAGE TRAY**.....Stores 110 diskettes.....comes complete with index-dividers, dust cover, tilt plates and adjustable spacing.....$55.00.

(18) **WORD-STAR**.....The ultimate word processor.....a menu driven word processing system that can be used with any printer. All standard word processing commands are included.....plus many unique commands only found on WORD STAR.....requires CP/M.....$495.

(19) **MAIL LIST MERGE**.....An add on package that allows the user to send form letters (created on WORD-STAR) to any compiled mailing list (using any CP/M based MAIL program such as the PEACHTREE MAIL PROGRAM).....requires CP/M, WORD STAR and any CP/M based mail program.....$150.

(20) **EDITOR ASSEMBLER** from Galactic Software Ltd. is the first user oriented Editor Assembler for the MODEL II and was designed to utilize all the features of the MODEL II. It includes innovative features for ease of coding and debugging and complete documentation (over 120 pages) .....works under TRSDOS.....$229.

(21) **MAIL/FILE SYSTEM** from Galactic Software Ltd. stores 2,500 names per disk. No sorting time is required since the file is automatically sorted by first and last name plus Zip Code on input. Retrieve by any combination of 19 user codes. Supports an 11 digit alphanumerica Zip. Supports a message line. Comes complete with user-oriented documentation (100-page manual). Allows for company name and individual of a company and complete phone number (and extensions).....works under TRSDOS.....$199.

*TRS-80™ IS A TRADEMARK OF TANDY CORPORATION

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Reader Service—see page 242

I. C. flattery ahead.

Home-Brew TRS-80

Russell W. Steele
611 Lynden Ave.
Grass Valley, CA 95945

It's been said that the most sincere form of flattery is to be copied. But, when the copy is far superior to the original, it's called progress.

I have a friend and co-worker, Wilbur Dammann, who admired the TRS-80 and thought he might like to heve one. He is one of those guys who can see end make improvements in almost everything, from cars to solar systems.

Several of Will's friends used the TRS-80, so he recognized its potential, as well as some limitations such es the tricky CLOAD, slow clock speed, inadequate power supply and limited expansion capability (without an expensive interface unit).

He decided the solution to his problem wes to build e TRS-80

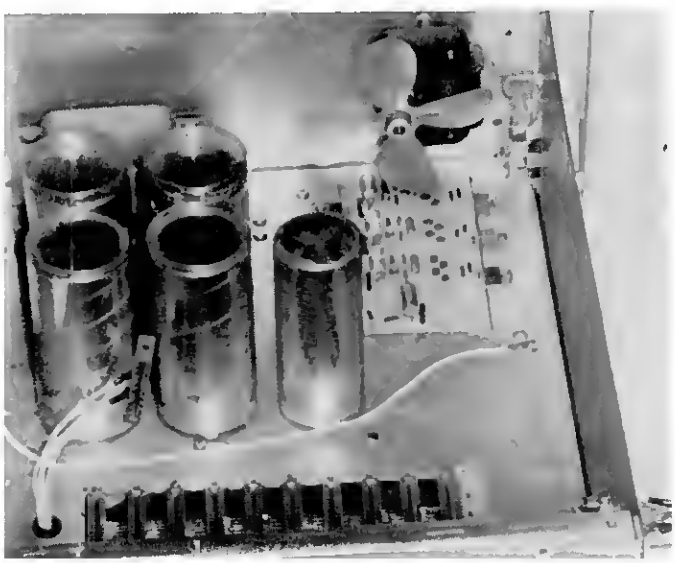

Photo 1. Interior Showing Power Supply.

1.	CLK 1	49.	A10
2.	GND	50.	NC
3.	CLK 2	51.	NC
4.	GND	52.	A3
5.	LI/LII ROM SELECT	53.	A15
6.	RESET	54.	NC
7.	BUSRQ	55.	NC
8.	RAM SELECT (4K)	56.	A1
9.	RAM SELECT (8K)	57.	A8
10.	RESTART (NMI)	58.	NC
11.	SYS RESET	59.	NC
12.	RAM SELECT (12K)	60.	A0
13.	RAM SELECT (16K)	61.	A13
14.	MODE SELECT (64 or 32 CHR)	62.	NC
15.	MUX	63.	NC
16.	VID/KBD ENABLE	64.	A9
17.	RAM SELECT (20K)	65.	A14
18.	CAS	66.	NC
19.	WR	67.	NC
20.	RAM SELECT (24K)	68.	A12
21.	RAM SELECT (28K)	69.	INT
22.	MREQ (RAS)	70.	NC
23.	OUT	71.	NC
24.	RAM SELECT (48K)	72.	A11
25.	RAM SELECT (44K)	73.	D4
26.	RD	74.	NC
27.	IN	75.	NC
28.	RAM SELECT (40K)	76.	D5
29.	RAM SELECT (36K)	77.	D3
30.	BUSAK	78.	NC
31.	WAIT	79.	NC
32.	RAM SELECT (32K)	80.	D6
33.	NC	81.	D7
34.	IORQ	82.	NC
35.	NC	83.	NC
36.	A5	84.	D1
37.	NC	85.	D0
38.	A4	86.	NC
39.	NC	87.	NC
40.	A2	88.	CLOCK SELECT
41.	RFSH	89.	O2
42.	NC	90.	NC
43.	MI	91.	+5 REG
44.	NC	92.	OVER VOLTS SENSE
45.	A6	93.	−5 REG
46.	NC	94.	+10 UNREG
47.	A7	95.	+12 REG
48.	NC	96.	+10 UNREG

Table 1. Motherboard Bus.

THOUSANDS OF COMPUTERS ARE GATHERING IN BOSTON.

The biggest and best computer show ever to be in the Boston area is ready to take place. Make sure you take it in.

Over $50 million worth of software and hardware for business, government, home and personal use will be featured at the new Northeast Computer Show in November. Computers from $150 to $250,000, mini and micro computers, data- and word-processing equipment, telecommunications, office machines, peripheral equipment and services will all be on display and for sale right on the spot.

All the major names like IBM, Xerox, Radio Shack and Apple will be there. There will be conferences on business uses of small to medium sized computers, and how to make purchasing evaluations.

Plus, robots, computerized video games, computer art and computer music will entertain and educate kids, spouses and people who don't know a program from a memory disk.

It's going to be a great show for everyone. Admission for adults is only $5. The public is invited, and no pre-registration is necessary.

Don't miss the coming of the computers. Show up for the show.

BOSTON
HYNES AUDITORIUM, PRUDENTIAL CENTER
THURSDAY-SUNDAY, NOVEMBER 20-23
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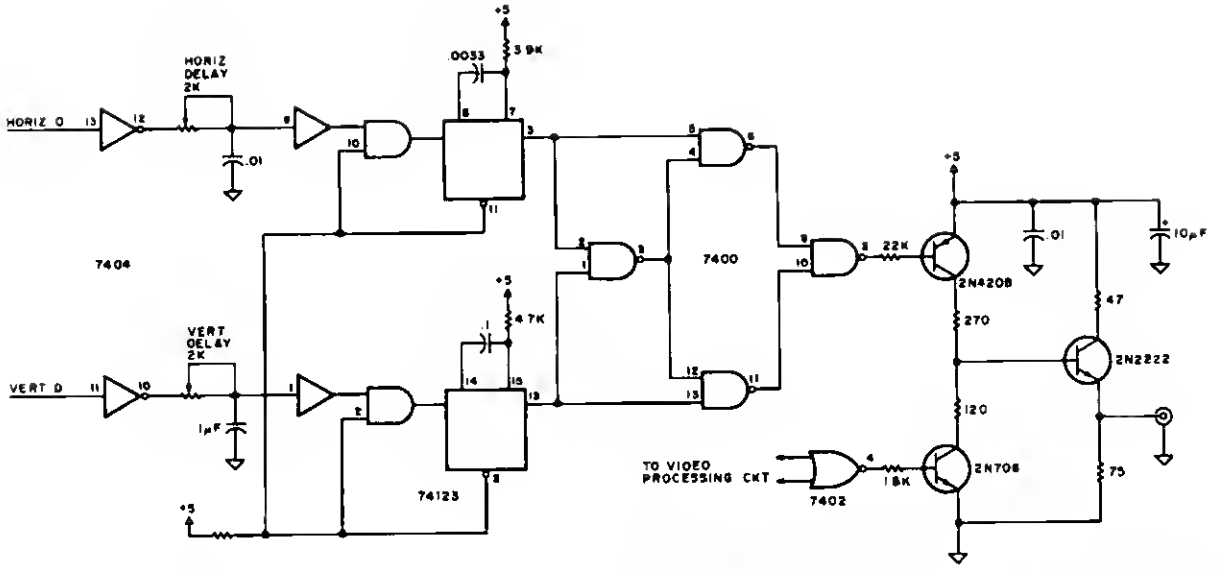


Fig. 1. Video Decode with Sync Pulse Generetor end Video Output Improvement.

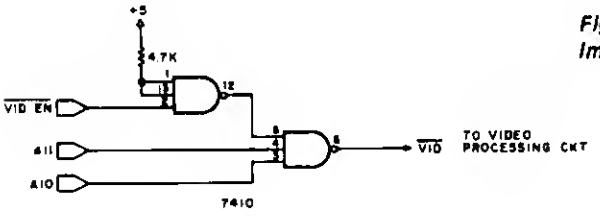
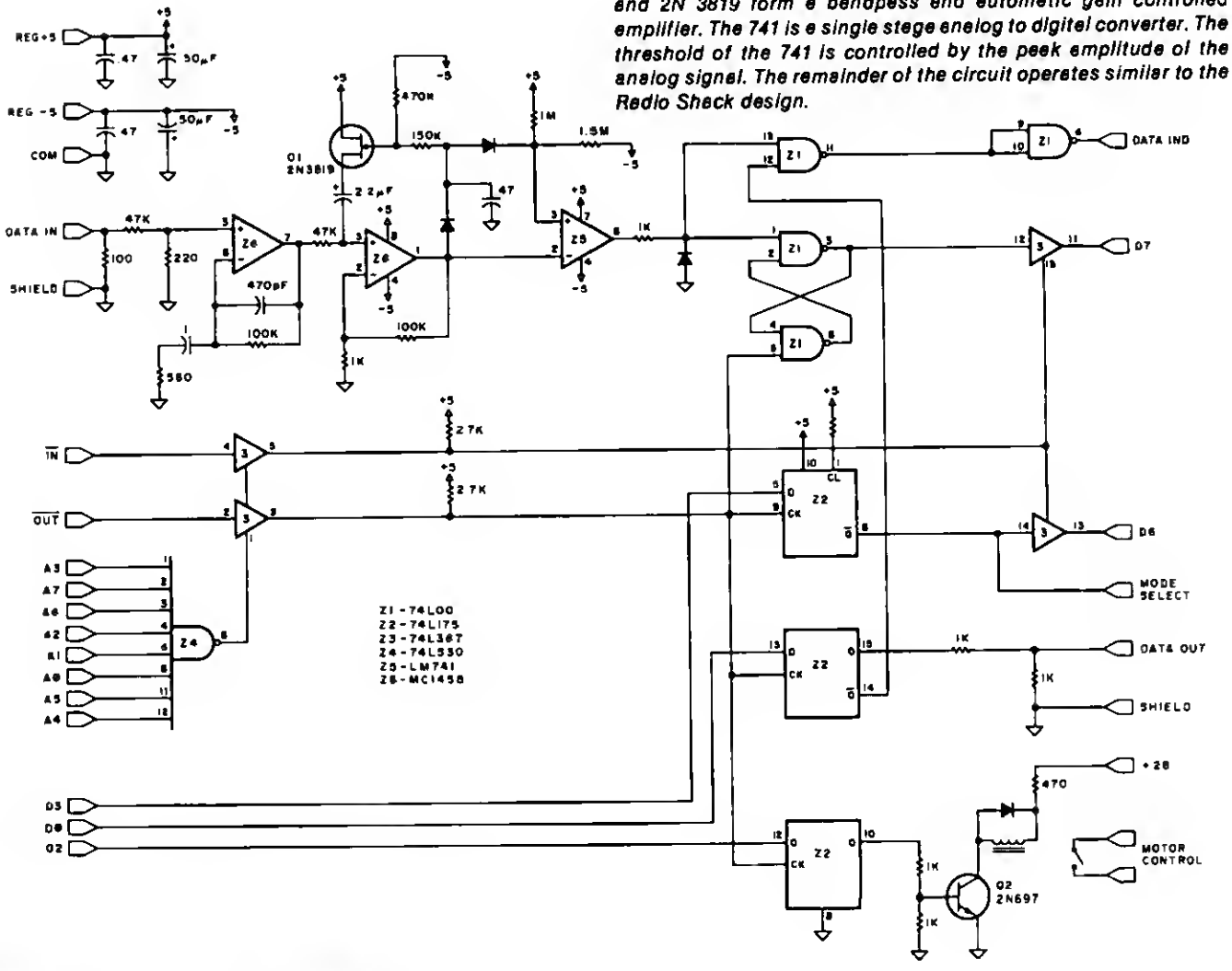


Fig. 2. This is e totelly redesigned cessette I/O circuit. The MC 1458 end 2N 3819 form e bendpess end eutometic gein controlled emplifier. The 741 is e single stege enelog to digitel converter. The threshold of the 741 is controlled by the peek emplitude of the enelog signel. The remeinder of the circuit operetes similer to the Redio Sheck design.



DOSPLUS 3.1

DOSPLUS VERSION 3.1 FACT SHEET

1) Variable length records.
2) Full lower case support and detection
3) Repeating keyboard w/debounce
4) Execute only protection feature for BASIC programs
5) Track support for 35-80 track drives
6) Device I/O handling (*PR, *DO, *KI)
7) Built-in screen printer
8) Multiple command chaining with "DO"
9) Built-in memory test
10) New printer driver which allows complete forms control and paging
11) Execute any DOS command from BASIC and return to BASIC
12) Free space map of diskette
13) Copy with variable length files
14) RS232 switch status and UART check
15) Create and pre-allocate files from DOS
16) Boot without re-setting clock and date
17) Display current time and date from DOS
18) New DISKDUMP sector display/modify (real-time)
19) New BACKUP (more reliable, no pack ID check)
20) New FORMAT (more reliable, no need to bulk erase disk first)

***************5 MORE UTILITIES***************

1) Single drive copy
2) Restore (dead files)
3) Purge (unwanted files)
4) Clearfile (destroy data with zeros)
5) Transfer (moves all files from one disk to another)

MICRO SYSTEMS SOFTWARE INC.
5846 Funston Street, Hollywood, FL 33023
(305) 983-3390

NAME _____
ADDRESS _____
STATE _____ ZIP _____
PHONE _____
ATTENTION! _____
ACCOUNT # _____
MC ☐ VISA ☐ EXP. DATE _____
MASTER DISKETTE DIRECTORY
QUANTITY _____
DOSPLUS 3.1
QUANTITY _____

Faster And More Efficient Than:

- TRSDOS
- NEWDOS +
- VTOS

DOSPLUS Uses less memory and still offers all the commands of the other major operating systems, AND some innovative and useful features of our own design.
DOSPLUS is now available for the TRS-80* Model I, II, and III

LIBRARY OF COMMANDS:

APPEND	ATTRIB	AUTO	BOOT	BUILD
CLEAR	CLOCK	COPY	CREATE	DATE
DEBUG	DEVICE	DIR	DO	DUMP
FORMS	FREE	KILL	LIB	LIST
LOAD	PAUSE	PROT	RENAME	RS232
TIME	TRACE	VERIFY		

BUILT-IN FEATURES:

AUTOMATIC LOWERCASE
SCREEN PRINTER
KEYBOARD DEBOUNCE
REPEATING KEYBOARD

UTILITIES:

COPY 1	RESTORE (DEAD FILES)	TRANSFER
DISK DUMP/CMD	FORMAT	PURGE
		CLEARFILE
		BACK-UP

NEW FROM MICRO-SYSTEMS!!!

Master Diskette Directory Ver 1.1

This program will read the directories of up to 320 diskettes or 5000 files! Insert your diskette in the drive, press enter, and it works automatically to read, store, and categorize your files. No more looking through box after box of diskettes looking for those favorite programs that are "Around Here Somewhere". You can get a listing of all the files on all the diskettes. In addition, you can list them by file extension, diskette number, or program category. With master directory, you need never again worry about the frustration of not being able to locate a particular program. Master directory will search for a particular file name and give you every occurence of that file, its size, and the diskette number that contains it.

A totally self contained, machine language program on a self-booting diskette; master directory will work equally well on single or multiple drive systems.

Dosplus - $99.95 Master Directory - $29.95

✓384
MICRO SYSTEMS SOFTWARE INC.
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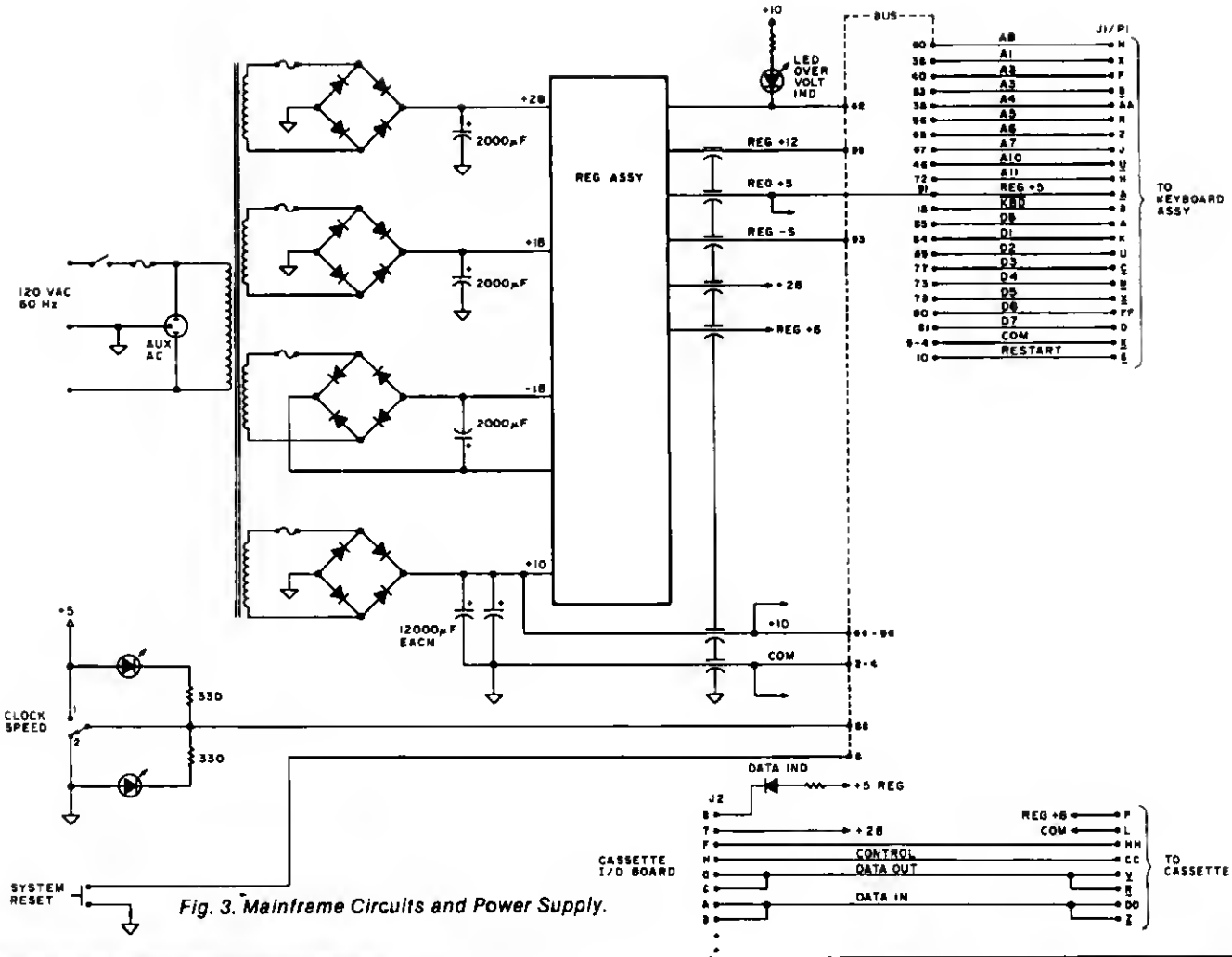

Fig. 3. Mainframe Circuits and Power Supply.

ACTION GRAPHICS

THE GREAT CRANE GAME MACHINE

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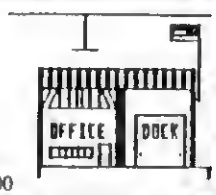

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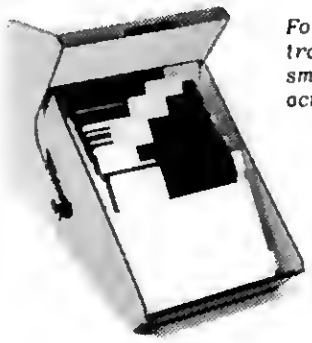

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compatible system from the ground up, improving, where he could, on the TRS-80 design.

Initial Circuit Design

Shortly after he became interested in the TRS-80, Will obtained a copy of its schematic. A few weeks later Radio Shack published the *TRS-80 Technical Reference Manual*. With both a schematic and technical data, the design advanced rapidly.

Will modified the clock circuit to select the CPU processing speed and improved the stability of the video display. He redesigned the CLOAD/CSAVE circuits, the systems control circuits and power supply. He added provisions for both Level I and II BASIC.

Schematics for the video sync, cassette input/output and power supply circuits are shown in Figs. 1, 2, 3 and 4.

Other modifications and design changes were made to reduce the number of parts to take advantage of those he had on hand and to improve performance.

One of Will's goals was to build as much of his system as possible from a bottomless junk box of electronic parts which he has collected over the years. Those parts he did buy (character generator, graphics generator, Level I and II ROM and assorted chips) came from Radio Shack. The CPU was purchased from an advertiser in the back of this magazine. All of the memory except for the video memory came from friends who kept their 4K chips when they upgraded to 16K.

Physical Layout

Will wanted a bus-oriented system which could be expanded as his needs and capabilities grew.

In approaching the layout problem, he grouped specific functions into blocks of processing, memory, video and input/output. Each function was assigned to a 5 by 7 PC board. To keep each function an integral block, he devised a series of piggyback boards for those circuits that could not be fit on the single 5 by 7 board. Each card was provided with its own 5-volt regulator and supplied 10 volts from a common power bus.

After juggling the circuit submodules until he found the best fit, Will's basic design evolved into a processor board, ROM board, RAM board(s), video board and cassette board.

The processor board includes the CPU, clock and first divider chain, and the reset functions. The ROM board has provisions for both Level I and II ROMs, plus the address decoder circuits for up to 48K of RAM. The current RAM boards, with plug-in assembly, are designed to hold two sets of 16-pin dynamic RAM chips. There is room on the motherboard for additional RAM boards with memory up to 48K.

The video board holds the video divider chain, multiplexer and video memory. A plug-in assembly holds the character graphics generator, sync circuits and video output. The cassette I/O board is built on a smaller 7 by 3 board, but is compatible with the bus structure.

Each printed circuit card is designed to plug into a 96-pin motherboard. The motherboard is built with double-sided PC board with alternate traces on opposite sides of the board. Fig. 5 shows how the 96-pin sockets were soldered to the board.

The bus structure is shown in Table 1. There is ample room on the motherboard for expansion.

Future expansion will include a parallel/serial I/O board, disk

Photo 2. The Complete System.

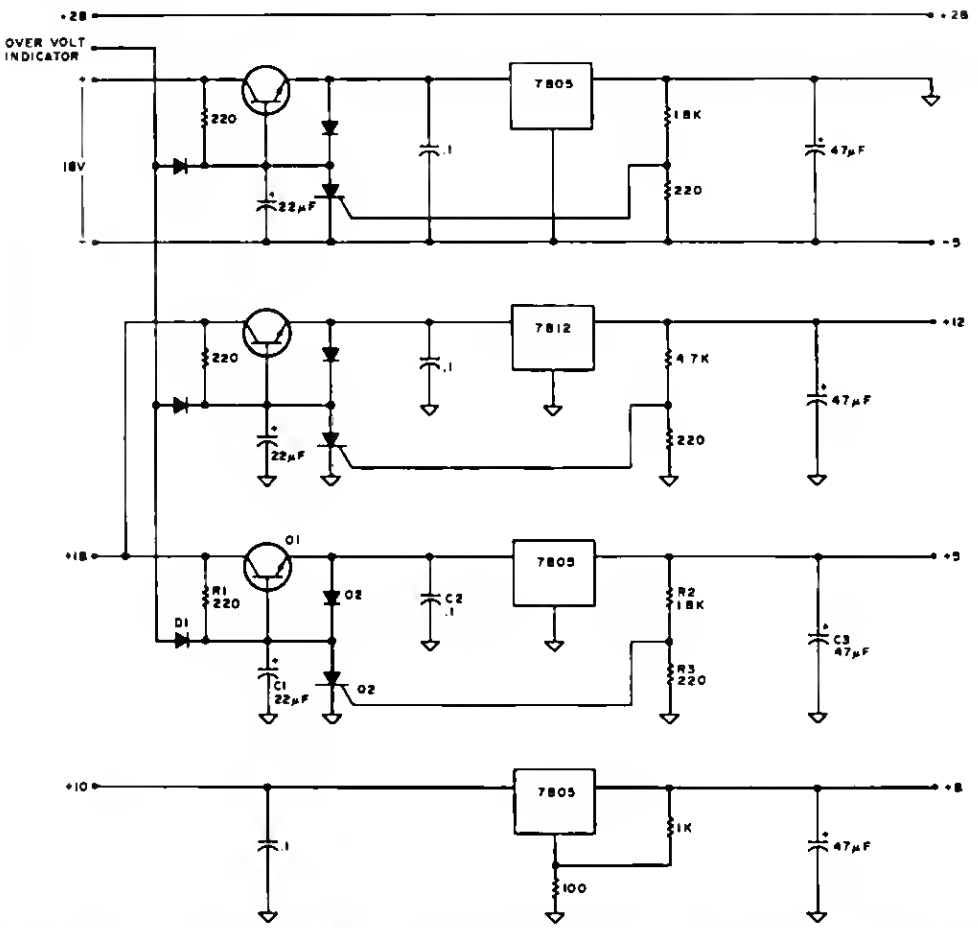

Fig. 4. Mainframe and Circuit Board Regulators Assembly. The regulator circuits use a unique overvoltage protection circuit. The transistor, SCR and resistors R2 and R3 are the principal components in the overvoltage protection scheme. The transistor, R1 and C1 form a dynamic filter.

Scanned by Ira Goldklang - www.trs-80.com

controller, A/D converter and of course, more memory. The circuit diagrams for each of the basic modules are shown in Figs. 6 through 9.

Will totally redesigned the power supply and incorporated it into the system. His primary power supply was built on the main chassis to provide unregulated 10 volts for the bus in addition to the regulated +12 volts and −5 volts required by dynamic RAM memory.

Each regulated voltage source has a unique dynamic filtering and overvoltage protection circuit. They shut down the power to the circuit by turning off Q1 and illuminating an overvoltage LED indicator on the front panel. (The schematic for this circuit is included as Fig. 4.) This is not a crowbar circuit that could blow a fuse, but an electronic control of the overvoltage condition. Transistor Q1, resistor R1 and capacitor C1 also provide the dynamic filtering.

In addition to the power supplied to the bus, a regulated six volts is provided to the tape recorder. By operating the recorder on regulated six volts, the voltage fluctuations caused by the recorder being switched on and off are eliminated. The possibility of 60-cycle hum creeping into the recorder is also reduced.

To provide power for future control functions and provide more reliable tape recorder relay operations, a +28-volt DC source was included as part of the power supply. A single transformer with all the necessary voltages was not available, so Will rewound an old one.

As you can see in Photo 1, the primary power supply fits neatly into the case. A small fan was installed to provide enough cooling for reliable operation.

Construction

Will carefully drew each PC board circuit on tracing paper, using black ink for the top PC traces and red for the bottom PC traces. Each diagram was carefully checked and a circle made to indicate an IC connection, discrete component connection or a connection that passed through to the other side of the

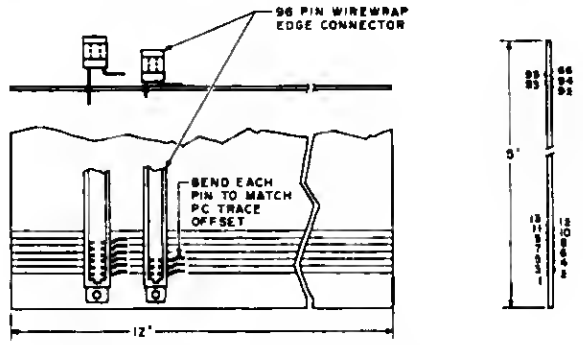

Fig. 5. Details of Mother Board Construction.

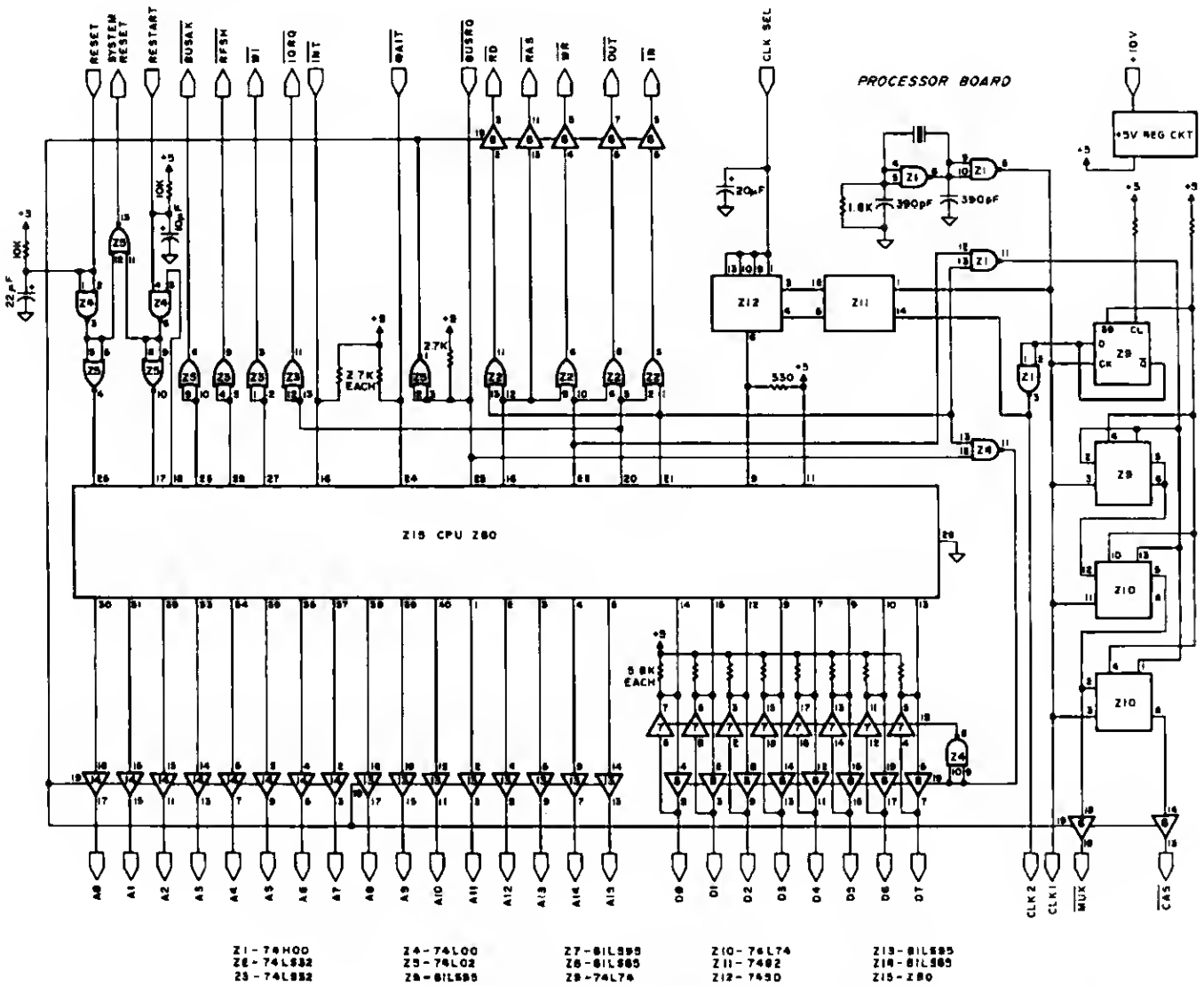

Fig. 6. The Basic Processor Board.

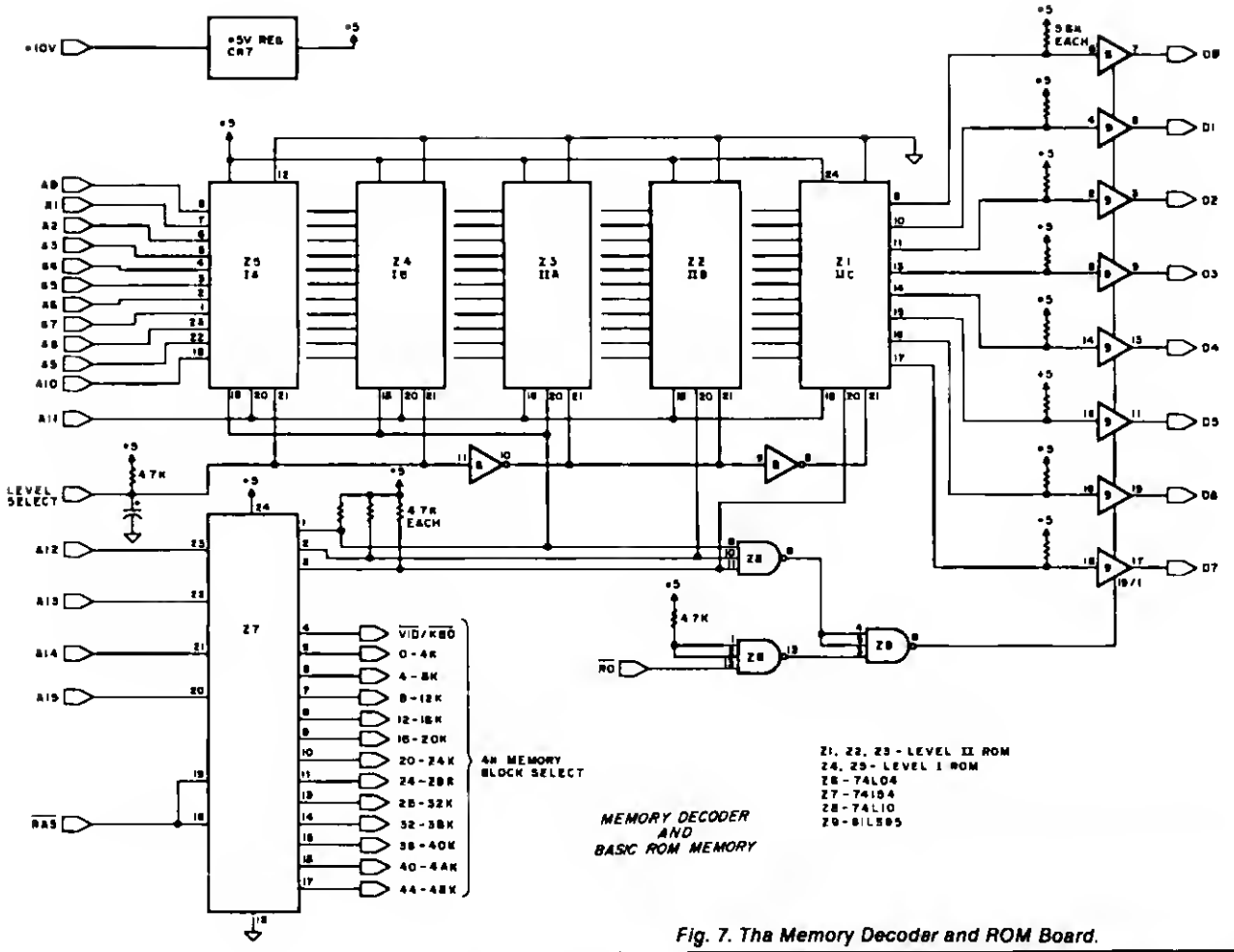

Fig. 7. The Memory Decoder and ROM Board.

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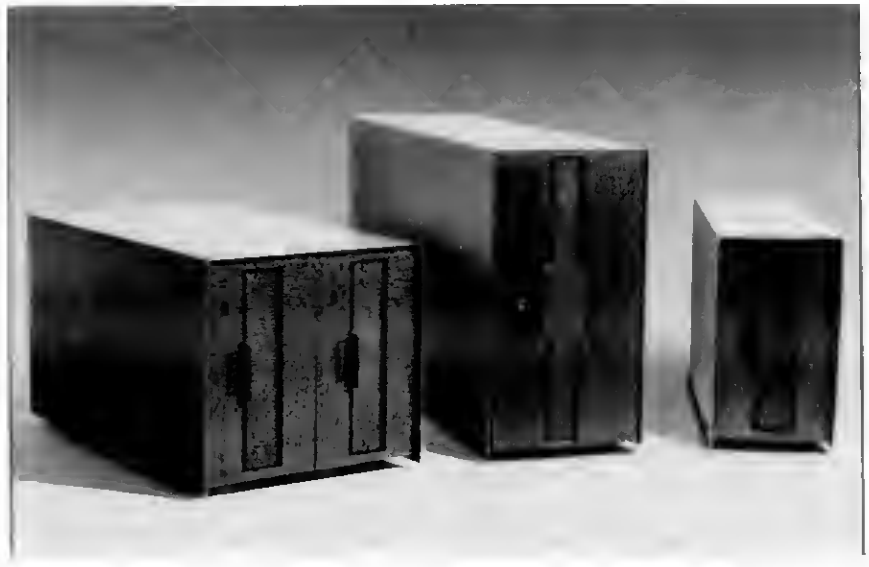

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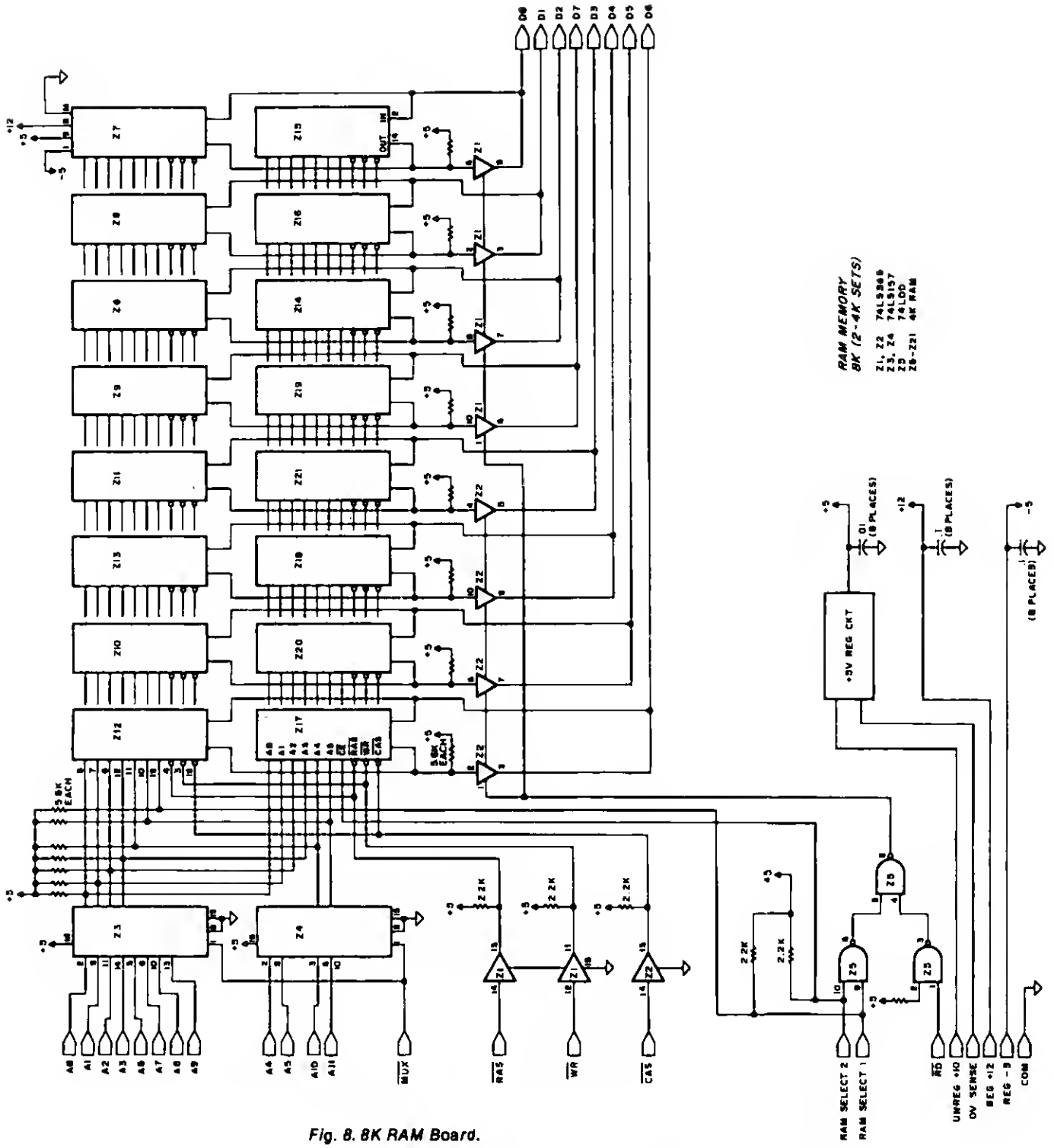


Fig. 8. 8K RAM Board.

board.

Next, Will pasted the diagram to a double-sided PC board with rubber cement and drilled holes in it with a dental tool. The holes would be a guide for drawing on the PC traces with waterproof ink.

The copper was scrubbed clean before drawing the PC traces.

Problems with ordinary drafting pens developed because the waterproof ink dissolved their plastic parts. Will devised an all-metal mechanical pen to drew the traces.

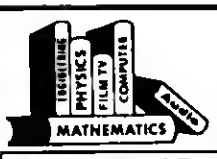
Once the circuits were drawn on the copper boards, they were etched in ferric cloride. Next the cards ware washed and the copper traces tinned with a hot soldering iron.

Parts mounting was typical for PC boards, except at points where parts passed through the board. Without through-hole plating, it's necessary to solder the leads on both sides of the board.

The only other exception to normal construction practices was the building and installing the piggy-back boards. Gold-plated cable-connector-pins were soldered into the appropriate address, data and control lines.

Memory Boards and Keyboard

After the memory boards were installed and checked out, Will experianced a number of program glitches. Tracking down the problem, he discovered individual memory bits were modified at random. Running a memory test tape pro-



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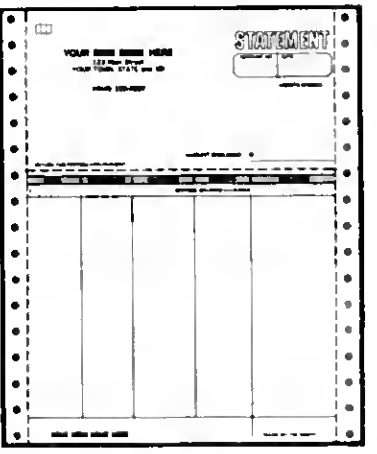

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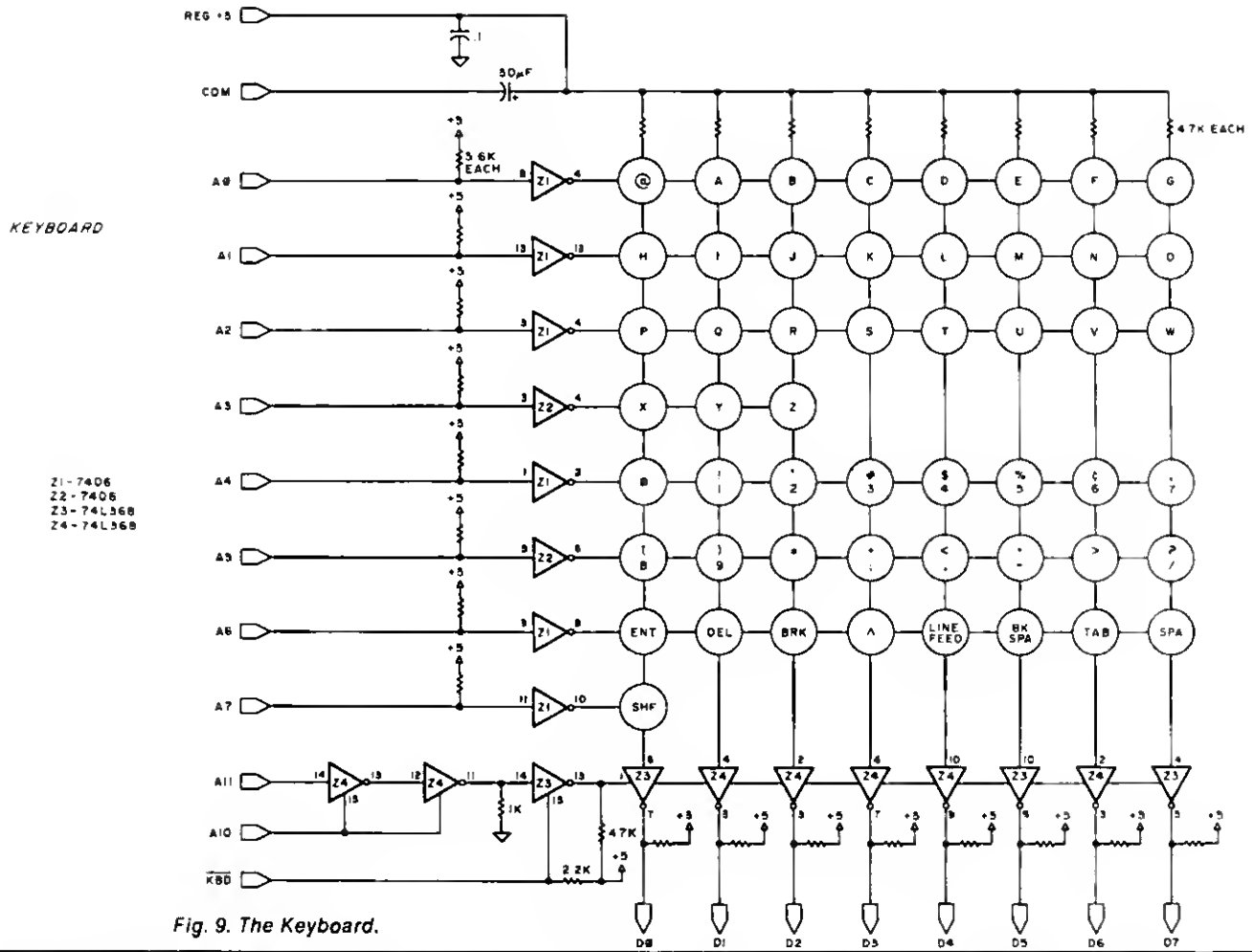

Fig. 9. The Keyboard.

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duced inconclusive results, as the error location moved or disappeared.

When the piggyback board was removed, the memory check results were fine. After exchanging chips and putting the piggyback chip set on the mein board, another memory check also showed good results.

It was mysterious. The problem seemed to be similar to the memory problems some TRS-80 users were heving with the 32K and 48K memory in the expansion interface. Will solved the problem by putting pull-up resistors on the memory output data lines and the address lines coming from multiplexers Z3 and Z4 in Fig. 8.

Will's original keyboard was taken from a key-punch machine and modified extensively. After much labor he abandoned the keyboard beceuse its momentary contact switches would not work with e text editor or eny application where a repeat function was required.

Will replaced it with a 63-key unencoded keyboard from Jameco. This keyboard, shown in Photo 2, has given excellent service so far, with few key-bounce problems.

Will modified the Jameco keyboard so that a blank key is used to disable the cassette remote control, rather than a separete switch on the console.

Video Display and Cassette I/O

The video display is a converted nine-inch Panasonic black end white TV set. Will stripped the TV set of all non-essential parts, such as the tuners, IF strips and demodulation circuits. He redesigned the video input circuit to improve the character definition and to accept the standard video signal coming from the computer. The resulting video is much sharper than the standard TRS-80 display.

Will's redesigned CSAVE/CLOAD circuits have been a boon for his friends who own TRS-80s. Whenever one of us encounters a hard-to-load tape, we ask him to loed it on his machine to make a new copy.

His home brew 80 can load tapes that none of the other machines will accept, and his output is exceptionelly sharp. Will's cassette I/O circuit is shown in Fig. 2. Note the field effect transistor in the second op amp stage. This transistor autometically sets the amplifier gain, presenting a constant amplitude signal to the following stages.

The decoding circuit is built around the MC1458 rather than the LM 3900 used in the TRS-80. The LM 3900 proved to be unstable under high current conditions. When the lest stage of the LM 3900 was saturated, it disrupted the operation of the first and second stages. The end result was a fluctuating, unstable signal.

Since Will did not like the location or operation of the reset switches on the TRS-80, he designed a system restart. It performs the same function as the TRS-80 reset located in the expansion interface port. He added a separate system reset.

The reset function is a true system reset, similar to the TRS-80 power up reset. However, power is never removed from the system. The reset clears the memory and returns you to the MEMORY SIZE? or READY prompt.

Summary

I'm not recommending that everyone should build his own 80. Will drew on years of experience as a technician and invested hundreds of hours in his lab to get some of the circuits to operate correctly. In the process, he increased his knowledge and understanding of digital circuits and his friends learned more about their TRS-80s as the work progressed.

In the final analysis, Will's computer is not a TRS-80, but rather a TRS-80 compatible system, loosely based on the Radio Shack design.■

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See reviews in July 80 and August 80 BYTE By Jerry Pournelle.

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✓ Reader Service—see page 242

A close look at using arrays around the house.

Of Two Dimensional Arrays

R. L. Conheim
1329 Stanley Avenue
Dayton, OH 45404

When I opened my utility bill the other day, I wasn't prepared for a surprise. The previous month's weather was mild, so neither the furnace nor the air conditioner ran very much. Surprise was not exactly my reaction. Anger and frustration were more appropriate descriptions. The bill was three times as high as the previous month's.

By the time I calmed down, I realized that a previous meter reading had been grossly in error—in my favor—and my current bill was merely playing catch-up. Too bad I hadn't put my TRS-80 to use keeping track of those bills. I could have learned a lot.

Utility Bill Program

Necessity is also the mother of programs, to paraphrase an old saw, so I proceeded immediately to outline what I wanted a utility bill program to do.

Basically I wanted comparisons: this month with last, this year with last, accumulated year-to-date information about both units of energy and cost, a monthly cost-per-unit comparison so I could see what was happening to rates.

This kind of information could also give me an idea of how well my conservation efforts were working. Did insulating the basement really do anything economically sound? And, when I went around the house turning off lights, was I really accomplishing anything more than annoying the rest of the family?

I also wanted to develop a basic array which I could use for a variety of things. The program which resulted was a straightforward exercise in BASIC, except for a few sallies into uncharted waters. Among these you're-on-your-own objectives were: to include calculated data along with input data in the array, print a single column or a single row and line up data which varied in length so the array would be easy to read.

While I was about it, I investigated mixing string with numeric data. This turned out to be sticky, and required more experimentation than any of the other areas of investigation. None of my books gave much information on these areas, but reason, patience and dumb luck pointed the way.

I needed a couple of two-di-

```
                    T H I S   Y E A R
                                CUM        CUM        COST PER
MONTH     UNITS     COST       UNITS      COST          UNIT
 1         925      43.03       925        43.03      .0465189
 2         613      31.98       1538       75.01      .0521697
 3         678      35.61       2216       110.62     .0525221
 4         580      31.62       2796       142.24     .0545173
 5         762      39.05       3558       181.29     .0512467
 6         1129     50.25       4687       231.54     .0445084
 7         1209     53.73       5896       285.27     .0444417
 8         282      17.74       6178       303.01     .0629078
 9         548      29.87       6726       332.88     .0545073
 10        514      28.78       7240       361.66     .0559922
 11        2045     79.57       9285       441.23     .0389095
END OF DATA

                    L A S T   Y E A R
                                CUM        CUM        COST PER
MONTH     UNITS     COST       UNITS      COST          UNIT
 1         0         0          0          0          0
 2         0         0          0          0          0
 3         0         0          0          0          0
 4         0         0          0          0          0
 5         602      27.39       602        27.39      .0454983
 6         1485     53.44       2087       80.83      .0359865
 7         1663     62.91       3750       143.74     .0378292
 8         1494     58.02       5244       201.76     .0388353
 9         1452     58.57       6696       260.33     .0403375
 10        645      32.88       7341       293.21     .0509768
 11        743      36.62       8084       329.83     .0492867
 12        853      39.57       8937       369.4      .0463892
END OF DATA
```

Example 1. Comparison of Utility Bill Arrays

```
READY
>RUN

                    T H I S   Y E A R
                                CUM        CUM        COST PER
MONTH     UNITS     COST       UNITS      COST          UNIT
 7         1209     53.73       0          0          .0444417
                    L A S T   Y E A R
                                CUM        CUM        COST PER
MONTH     UNITS     COST       UNITS      COST          UNIT
 7         1663     62.91       0          0          .0378292
COMPARISONS ARE FOR MONTH  7
CURRENT USAGE IS  454  UNITS OR 27.3001 % LESS THAN LAST YEAR

CURRENT COST IS $ 9.18  OR 14.5923 % LESS THAN LAST YEAR
READY
```

Example 2. Comparison of a Single Month

mensional arrays—one for the current year's information and one for the previous year. The string arrays which defined the names of the months were integrated with their numeric counterparts. By using a menu I could choose between entering new data or examining the arrays. Additionally, at the end of the array printing, I could make provisions for comparing any given current month with its previous year counterpart, showing unit and percentage differences.

Using data statements and reading them into the program turned out to be the best method of feeding information to the arrays, because data statements became part of the program and were retained by it.

The string array for the names of the months caused several headaches. It wound up inside the numeric array printing loop (lines 520 through 570). Every time I tried to separate the string from the numeric arrays, I got a syntax error where no error seemed to exist. Using the TRON technique of tracing the progress of a program, I determined that the error was caused when the program attempted to read data that wasn't there.

The numeric arrays were slightly unusual in that only two of the five columns were input to the program. The other three were calculated. That meant reading only two columns of numeric data, but printing five. The last three columns were calculated for the current year's array in lines 580 through 600 and 630 through 650. I identified both the input data and the calculated data by X-Y coordinates. The rows comprised the X axis and the columns made up the Y axis. So, for printing you could identify any data item by row and column, identify a single row or identify a single column.

When I first experimented with this program I did not have data for some months of the previous year. To keep the arrays working properly, I entered zeros as data. This caused a further problem in calculating the cost per unit column because the program attempted to divide by zero—a no-no which caused a /0 error. To keep this error from gumming up the works I included an ON ERROR GOTO statement at line 100.

It is best to leave this statement out until you have debugged the program because with it, any type of error will cause the program to jump immediately to READY.

A Closer Look

Lines 240 through 280 provide instructions for inputting data to the program. The line number to be used, and the order in which data is to be typed is provided by these instructions. The program then reverts back to the menu. If you then select "2," you will get a readout of both arrays and, should you want it, a comparison of like months in the two years.

Lines 300 and 310 print the table headings. Data for the current year is entered in lines 380 through 490. Note that data is provided in our example for only January and February of the current year. We have reserved lines 400 through 490 for ensuing months. This is not essential unless you plan to use a renumbering program. The simplest way of reserving these lines is with the apostrophe, the abbreviation for REM.

Line 360 for the numeric array and line 550 for the string array keep execution in order when all data is not available for the entire year.

The printing program for the first array (the current year) starts on line 500 and continues through line 670. The statement in line 610 now calls for five columns, not just the two we read. This handles the printing of the calculated numeric data. The continuation statement in line 710 stops the display after the first array, if you are displaying rather than printing. For printing, you won't need this line.

To keep the columns left-justified TAB(X) is used in line 660. The value of X is set by line 510 and altered in line 620. Each time a column is printed, ten is added to the value of X.

The second array is set up and printed in lines 740 through 1080. The monthly comparisons are programmed in lines 1100 through 1500. Note that a month

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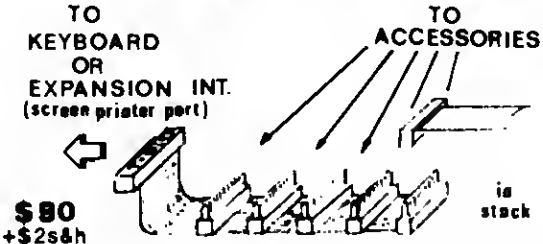

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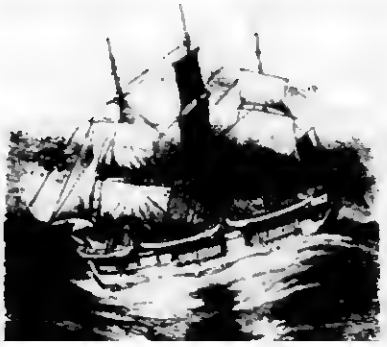

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identifier, N, (1350 and 1450) is required to compute the data. When item 2 of the menu is selected, there is no request for a month, so N is inserted in 1300. The month to be compared is determined by 1280 through 1300.

It is possible, of course to select a month for which there is no current data. To handle that situation the latest month for which there is data is identified in line 690. If the month selected is more than that, line 1290 prints out a not-available statement (line 1520).

When a month has been selected for comparison, the data is printed. This is done in lines 1330 through 1500, after restoring the read capability in line 1270. After the data have been printed, comparisons are made in lines 1100 through 1220. The absolute values (ABS) are compared to prevent any printout of minus signs.

Other Applications

The arrays set up in this program can be used for electricity, gas, or water with no change other than writing line 120 to suit the application. In the printed headings we have used general terms such as units rather than KWHR or CuFt.

You can also use the two-dimensional arrays for keeping track of income tax deductions, medical costs, insurance payments, or breakdowns of the household budget.

One final word. In order to retain new data as you add data statements, don't forget to CSAVE the entire program after each group of inputs.■

Program Listing 1. BASIC Two-dimensional Array

```
50 CLEAR 100
60 DIM UT(12,6)
70 DIM LY(12,6)
80 DIM M$(12)
90 DIM N$(12)
100 ON ERROR GOTO 1310
110 CLS
120 LPRINT "ELECTRICAL USAGE AND COST":LPRINT
130 INPUT "ENTER PRESENT CALENDAR YEAR";CY
140 PRINT TAB(24);"UTILITY BILL WATCHER"
150 PRINT TAB(20);"1.ENTER NEW BILL INFORMATION"
160 PRINT TAB(20);"2.EXAMINE DATA TABLES"
170 INPUT"PLEASE SELECT 1 OR 2";M
180 IF M = 1 GOTO 200
190 IF M=2 GOTO 300
200 INPUT "WHAT MONTH (NUMBER)";N
210 IF N > 12 PRINT "INCORRECT ENTRY":GOTO 170
220 LET D = (N * 10) + 370
230 CLS:PRINT:PRINT
240 PRINT "DELETE 'END' FROM LINE 570. THEN ADD NEW MON
    TH, COMMA, AND 'END' TO 570."
250 PRINT "ENTER NEW DATA AT LINE ";D;" IN FORMAT - LIN
    E NUMBER,THE WORD 'DATA' UNITS USED, COST, 13 WITH
     COMMAS AS INDICATED."
260 PRINT "USE '13' AT END OF CURRENT MONTH ONLY - BUT
    NOT ON DECEMBER."
270 PRINT "DELETE '13' FROM PREVIOUS LINE, IF USED"
280 PRINT "FINALLY, TYPE GOTO 140"
290 STOP
300 LPRINT TAB(30);"CUM";TAB(40);"CUM";TAB(51);"COST PE
    R"
310 LPRINT "MONTH";TAB(10);"UNITS";TAB(20);"COST";TAB(3
    0);"UNITS";TAB(40)"COST";TAB(53);"UNIT"
320 LPRINT TAB(20);CY;" DATA"
330 FOR ROW = 1 TO  12
340  FOR COL = 1 TO 2
350 READ UT(ROW,COL)
360 IF UT(ROW,1) = 13 GOTO 500
370 NEXT COL,ROW
380 DATA 784,42.84
390 DATA 836,44.88,13
400 '
410 '
420 '
430 '
440 '
450 '
460 '
470 '
480 '
490 '
500 FOR ROW = 1 TO 12
510 X = 10
520 FOR Q = 1 TO 12
530 READ M$(Q)
540 IF M = 3 GOTO 1330
550 IF M$(Q) = "END" GOTO 680
```

Program continues

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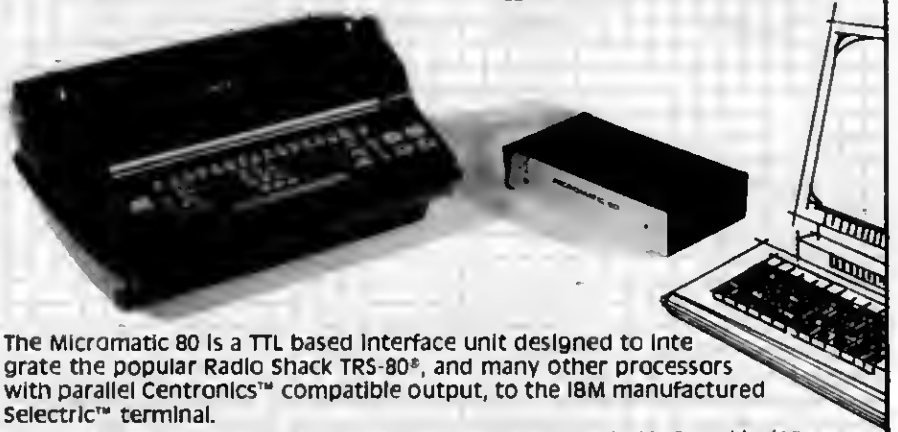

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```
560 LPRINT N$(Q);TAB(10)
570 DATA JAN,FEB,END
580 SR = SR + UY(ROW,1)
590 SC = SC + UY(ROW,2)
600 CR = UY(ROW,2)/UY(ROW,1)
610 FOR COL = 1 TO 5
620 X = X + 10
630 UY(ROW,3) = SR
640 UY(ROW,4) = SC
650 UY(ROW,5) = CR
660 LPRINT UY(ROW,COL);TAB(X);
670 NEXY COL:LPRINT:NEXT ROW
680 LPRINT "END OF";CY;"DATA"
690 R = RON
700 E = 0
710 INPUT "TO CONTINUE PRESS ENTER";E
720 PY  = CY - 1
730 IF E =  0 GOTO 740
740 LPRINT TAB(20);PY;" DATA"
750 FOR ROW = 1 TO 12
760  FOR COL = 1 TO 2
770 READ LY(ROW,COL)
780 NEXY COL,ROW
790 DATA 923,43.83
800 DAYA 613,31.98
810 DAYA 678,35.61
820 DAYA 580,31.62
830 DATA 762,39.85
840 DATA 1129,58.25
850 DATA 1209,53.73
860 DAYA 282,17.74
870 DATA 548,29.87
880 DATA 514,28.78
890 DATA 2845,79.57
900 DATA 628,34.96
910 FOR ROW = 1 TO 12
920 FOR Q = 1 TO 12
930 X = 10
940 READ N$(Q)
950 IF  N = 3 GOTO 1440
960 LPRINT N$(Q);TAB(10)
970 DATA JAN,FEB,MAR,APR,MAY,JUNE,JULY,AUG,SEPY,OCT,NOV
    ,DEC
980 IF LY(ROW,1) = 0 GOTO 1020
990 SL = SL + LY(ROW,1)
1000 SD = SD + LY(ROW,2)
1010 CM = LY(ROW,2)/LY(RON,1)
1020 FOR COL = 1 TO 5
103E X = X + 10
1040 LY(ROW,3) = SL
1050 LY(ROW,4) = SD
1060 LY(ROW,5) = CM
1070 LPRINT LY(ROW,COL);TAB(X);
1080 NEXT COL:LPRINT:NEXT ROW
1090 IF N=3 GOTO 1100ELSE 1250
1100 A1 = LY(N,1) - UY(N,1)
1110 IF UY(N,1) < LY(N,1) A$ = "LESS" ELSE A$  ="MORE"
1120 A2 = A1/LY(N,1) * 100
1130 A2 = INT((A2+.005)*100)/100
1140 LPRINT "COMPARISONS ARE FOR ";N$(N)
1150 LPRINT CY;"USAGS IS ";ABS(A1);" UNITS";" OR";ABS(A
    2);"% " A$;" THAN";PY
1160 A3 = LY(N,2) - UY(N,2)
1170 A3 = INT((A3+.005)*100)/100
118E IF  UY(N,2) < LY(N,2) B$ = "LESS" ELSE B$ = "MORE"
1190 A4 = A3/LY(N,2) * 100
1200 A4 = INT((A4+.005)*100)/100
1210 PRINT
1220 LPRINT CY;"COST IS $"; ABS(A3);" DR";ABS(A4);"% "
    B$;" THAN";PY
1230 INPUT "DO YOU NANT ANOTHER COMPARISON (Y/N)";C$
1240 IF C$ ="N" GOTO 1320ELSE 1270
1250 INPUT "DO YOU NISH A MONTNLY COMPARISON (Y/N)";Y1$
1260 IF Y1$ = "N" GOTO 1320ELSE 1270
1270 RESTORE
1280 INPUT "WHAY MONTN (NUMBER)";P
1290 IF P > R-1 GOTO 1520ELSE 1300
1300 N = P: N = 3: GOTO 320
1310 RESUME 1320
1320 END
1330 IF N$(Q) = "END" GOTO 1350
1340 NEXT Q
1350 LPRINT N$(N);TAB(10)
1360 UY(N,5) = UY(N,2)/UY(N,1)
1370 X = 10
1380 FOR  COL = 1 TO 5
1390 X = X + 10
1400 LPRINT UY(N,COL);TAB(X);
1410 NEXY COL:LPRINT
1420 GOTO 720
1430 X = 10
1440  NEXT Q
1450 LPRINT N$(N);TAB(10)
1460 LY(N,5) = LY(N,2)/LY(N,1)
1470 FOR COL = 1 TO 5
1480 X = X +  10
1490 LPRINT LY(N,COL);TAB(X);
1500 NEXY COL:LPRINT
1510 GOTO 1100
1520 PRINT CY; "DAYA NOT YET AVAILABLE FOR MONTN SELECT
    ED": GOTO 1230
```


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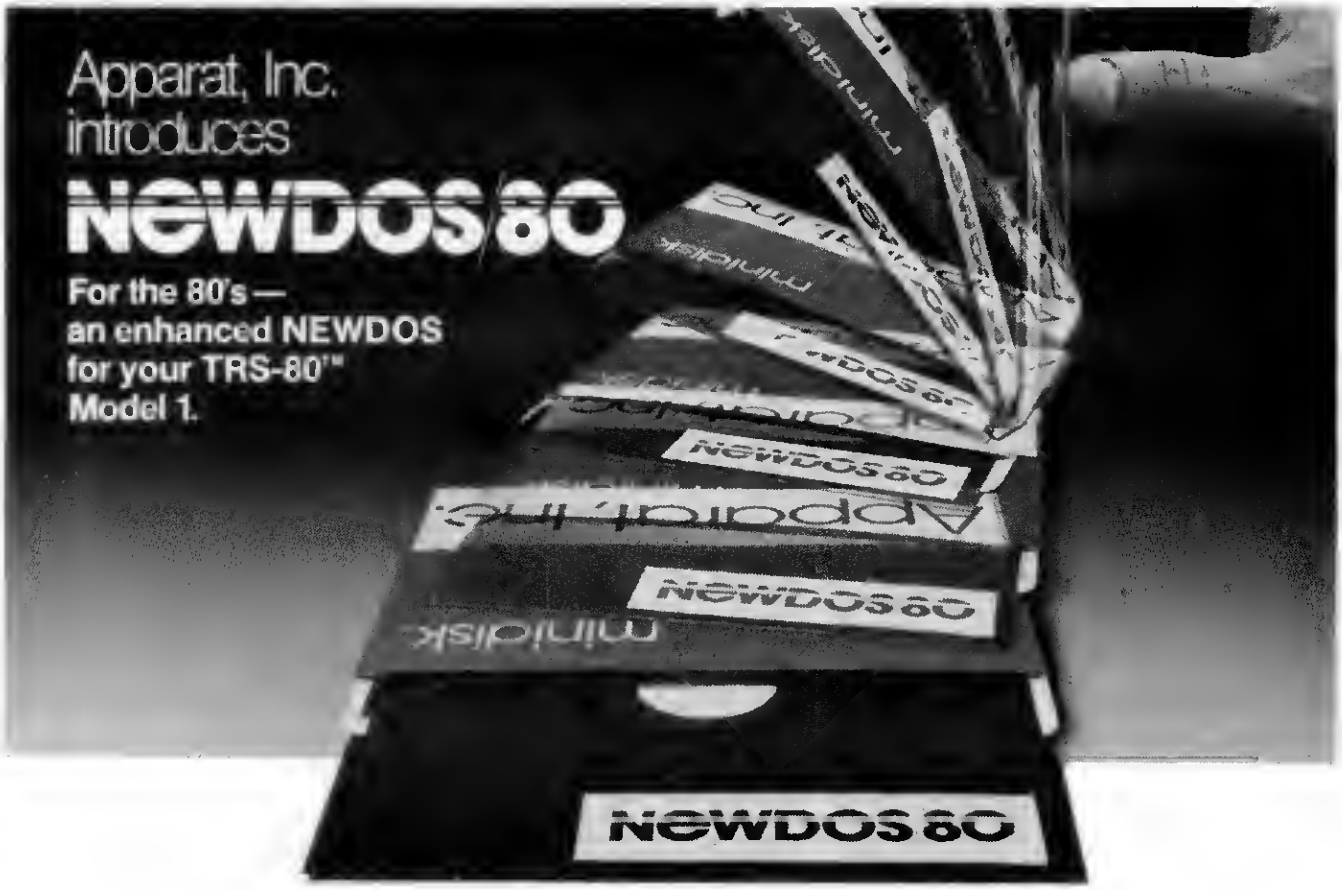

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Sound exercises in machine code.

Cheap Trills with T-BUG

Allan S. Joffe
1005 Twining Road
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This time around our programming exploration delves into some loop structures and explains a means of producing tones on your TRS-80.

Every time you CSAVE your 80 is recording tones on its cassette. The means to this end is a four-bit latch in the computer, accessed via the A register.

If you turn the correct bit of this latch on and off at an audio rate, you can produce a tone. You cannot simply turn this bit on and off, but rather, you have to turn it on and hold it on for a time, and then turn it off and hold it off for a time. If you didn't do this, the tone would be inaudible.

Two Loops

The time delay requires a loop; in actuality, two: a turn-on loop, and a turn-off loop. These are located in Program Listing 1 with the five bytes starting at 4A04. A similar loop starts at 4A0D. Each of these loops which use the D register controls the on and off latch time through the A register listings which follow them.

There is yet another loop in the program that controls just how many times the program will pass by the two loops that we have already examined. This loop uses the BC register pair and starts at location 4A00 extending to 4A03.

> *"There is yet another loop in the program that controls just how many times the program will pass by the two loops . . . already examined."*

Starting with location 4A16, this loop is tested for a zero condition to see if the count in the BC register has been fully decremented. If this is not the case, then the program returns to location 4A03 and continues decrementing the contents of the BC register pair.

When this count has been reduced to zero, the program falls through to 4A18 which returns to the BASIC auxiliary program.

It is this BASIC program that originally called this machine language routine by means of the USR(0) function.

Let's examine this machine language routine more closely. Consider a point that is easy to forget. The 01 opcode at origin 4A00 means LOAD register pair BC nn. This means that the register pair is loaded in memory locations 4A01 and 4A02. The value in 4A01 is loaded into the C register and represents the least significant bit. The value in 4A02 is loaded into the B register and represents the most significant bit.

(This business of the apparently backwards process of an instruction saying LOAD BC, and then actually loading CB can lead to confusion later on in the program.)

One of the most valuable features of T-BUG is the break point, and we can use this to examine the matter at hand.

If we assume that the first three bytes of the program are 01 FF AA, let us set a break point at 4A03. Now, execute a J 4A00 and when the prompt sign returns to the screen, utilize the R function of T-BUG to examine the BC register pair contents. You will see that AA is indeed loaded into the B register, and FF is loaded into the C register. Now execute an F instruction to reinstate the program before going on.

What is all this leading up to? If memory location 4A16 contains a B1 instruction (OR C), we get a short burst of tone as the LOOP terminates when C register has been decremented to zero.

Remember, this C register contains the least significant bit contained in the register pair BC. Had you changed the contents of 4A16 to B0 (which is the instruction to OR B) and then ran the program, you would get a much longer tone burst, because the B register contains the most significant bit of the register pair BC.

Now, run the original listing with location 4A16 containing

the B1 (OR C) opcode. You will hear a short tone. If you examine the BC register contents, you will see that the C register has been decremented to zero, but that the B register still contains AA.

Now, change the contents of 4A18 to B0 (OR B) and run the program. You will get a much longer tone, and when the prompt appears, if you examine the BC register, you will see that the B register is now zero and the C register still contains FF.

If you want to get the last millisecond of time out of the loop, change the contents of location 4A17 to B0 (OR B) and then add the remaining bytes in order, just as they existed in the original program. This puts all these bytes into locations one removed from the original. If you put a break point at location 4A1B and run the program, you will see that both registers, B and C, are now decremented to zero.

If you timed this longest loop, you would get a value of about nineteen seconds. If you changed the contents of location 4A17 to 00 (NO OP) and ran the program again, you would get a time only about one half-second shorter than this, clearly showing that the value in the C register is truly the least significant portion of the register pair.

The Metronome

At this point let us combine the machine language routine with a BASIC program to test it out. Naturally, you will need a monitor program such as T-BUG. Load your monitor program using the SYSTEM command as usual. Then load Program Listing 1, starting at location 4A00.

With your monitor program, change locations 408E and 408F to 00 4A respectively. This is necessary to make the USR(0) function work, as outlined in your Level II book. Next, execute a J 1A19 to return to BASIC. Now load in the following short BASIC listing.

```
10  FOR X = 1 TO 60
20  J = USR(0)
30  FOR T = 1 TO 300:NEXT T
40  NEXT X
```

Origin or starting memory location is 4A00 hex

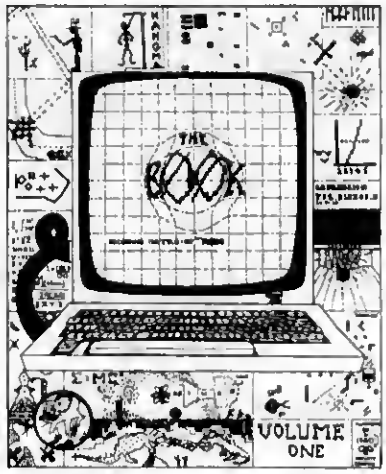
```
4AØØ    Ø1      LOAD  BC NN
4AØ1    FF
4AØ2    AA
4AØ3    Ø8      DECREMENT  BC
4AØ4    16      LOAD D,N
4AØ5    15
4AØ6    15      DECREMENT D
4AØ7    2Ø      JRNZ DIS
4AØ8    FD
4AØ9    3E      LOAD A,N
4AØA    Ø2
4AØB    D3
4AØC    FF
4AØD    16      LOAD D,N
4AØE    15
4AØF    15      DECREMENT D
4A1Ø    2Ø      JRNZ DIS
4A11    FD
4A12    3E      LOAD A,N
4A13    ØØ
4A14    D3
4A15    FF
4A16    B1      OR C
4A17    C2      JPNZ NN
4A18    Ø3
4A19    4A
4A1A    ØØ      NO OP
4A1B    C9      RETURN
```

Machine code listing for tone generation

BACK TO BASIC

THE BØØK

ACCESSING THE TRS-80* ROM



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At this juncture, the transmitted audio has to be amplified by way of the cord that normally goes to the input jack of your cassette recorder. On my tape machine (a CTR-41), this is the jack marked AUX. Remove the plug from this jack and put it into an amplifier of your choice.

Run the program and you will hear a series of medium frequency beeps, spaced about one second apart. After 60 beeps the program will stop and a READY will appear on your monitor. You now have a metronome, by daring to adventure into USR(0) and machine language.

At this point return to T-BUG using the SYSTEM command. You may have to use /17280 after entering SYSTEM to successfully return to T-BUG. If you try the normal /ENTER and get back to the MEMORY SIZE? power up condition this is the case. If this happens, your BASIC program will be gone and you will have to reset memory locations 408E and 408F, but T-BUG will still be present in memory.

The purpose of returning to T-BUG is to try the longer loop time, as previously indicated, by changing the instruction at location 4A16 from B1 to B0.

Now, return to BASIC, and run the same program that gave you your metronome. This time each tone burst will last for some 19 seconds, as you have accessed a much longer count.

For the next little demonstration return to T-BUG (by now this is becoming second nature), and change location 4A16 back to the original B1 instruction. Return to BASIC and load the following BASIC listing.

```
10  FOR X = 1 TO 60
20  J = USR(0)
30  G = 90-G
40  PRINT [a] 60,G
50  POKE 18949,G
60  POKE 18958,G
70  NEXT X
```

Now run this program and you will hear a sort of tweedle-dum, tweedle-dee effect similar to a European police siren.

A few words of explanation: The two locations being POKEd alternately with the values displayed at the top right of your monitor are locations 4A05 and 4A0E which happen to be the locations that contain the initial count in the O register. By using the POKE statements we are changing the count to be decremented in the D register.

We are also changing the length of time the cassette output port is being held on and off, and this causes the frequency of the tone to change.

Try these line changes. Change line 10 to read: 10 FOR X = 1 TO 45. Change line 30 to read: 30 G = G + 1.

Now, run the program, and you have a descending trill. If you wish to slow down the speed of the trill, merely insert a small time loop such as 55 FOR T = 1 to 25:NEXT T.

Higher Frequency

You have probably noticed that the lower the count that is initially POKEd into the D register, the higher the resulting frequency; and the higher the count initially in the D register, the lower the frequency produced.

If you'd like to try for ascending trill, try this.

```
10  FOR X = 1 TO 50
20  J = USR(0)
30  R = R + 1
40  G = 51 - R
50  POKE 18949,G
60  POKE 18958,G
70  NEXT X
```

A modest exercise in your basic programming skills might combine the ascending and descending trills and tie them into a repeating loop, so that when it is executed, your TRS-80 will give the resident canary a run for its birdseed.

Before we leave the arena, locations 4A08 and 4A11 (FD) in Program Listing 1 are of some interest. These are instructions couched in two's complement notation to return the D register, thus insuring that the program will indeed LOOP until the D register is decremented to zero.

If you consider the first D register loop which extends to location 4A08, for the loop to turn upon itself and decrement it must go back from location 4A08 to location 4A06, which, inclusively, is three steps back. It just so happens that FD is the two's complement form for minus three.■

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The fine quality software of The Bottom Shelf including its defined fields, editing features and blinking cursor off the Model I Radio Shack microcomputer has been established. Now it is time for the new. With the introduction of the Mod II, TBS went to work learning its secrets. This month will mark the introduction of major advances in business and database software for all Radio Shack computers - Mods I to III and even the little pocket computer. As this is being written, most titles are not known, but see your computer dealer or write for a catalog - all titles released are available at that time.

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Here are three (count 'em) new commands for this program saving utility.

T-BUG And Then Some

Mark Paxton
17903 Red Oaks Dr.
Utica, MI 48087

Have you ever wished for a command in T-BUG that wasn't there: like displaying an entire block of memory on the screen with one command, dumping memory with the ASCII codes, a clear screen command, or a command to move a block of memory from point A to point B?

This article shows you how to modify Level II T-BUG to add three new commands, plus where to insert the logic for your own commands.

New Commands

The format for the three additional commands is displayed in Example 1.

COMMAND	DESCRIPTION
C	Clear entire screen.
D aaaa	Dump 208 bytes of memory (with ASCII code) on screen, where aaaa is the beginning address.
S aaaa bbbb cccc	Shift (or move) memory contents from address aaaa to address bbbb for a length of cccc.

Example 1.

C Clear Command: To clear the screen, enter a C and the screen clears with the # symbol homed to (0,0), or 3C00H.

D Dump Memory Command: This command displays the contents of memory (in hex) for a given address. While T-Bug's M command examines one byte at a time, the D command displays 208 bytes of memory on the screen, along with each byte's ASCII code (where appropriate). Example 2 shows a sample.

Each line displays 16 bytes (or 10H bytes) of memory, with a space between every fourth byte on the line. On the right hand side of the display, between the two asterisks, are the ASCII codes for each of the 16 bytes in the corresponding line. Any time a non-printable character is encountered a period is put in place of the ASCII character.

If something less than 208 bytes on the screen at the same time is desired (i.e., 13 lines of 16 bytes each), you can easily modify the dump routine to handle this.

S Shift (or Move) Command: This command allows you to move a block of memory from one starting address to another.

The routine can even handle moves where the block of memory being moved from overlaps the block of memory being moved to. This is done by starting the move at the last byte in each block and decrementing, when moving a block up in memory, or by starting the move at the first byte in each block and incrementing, when moving a block down in memory. When blocks overlap, and the from address is less than the to address, you must start the move at the last byte in each block and decrement to the first byte. If you start at the first byte and increment, you will begin to destroy your original (from) block before it is safely moved to its new destination.

Program Listing 1 shows the source code for the additional commands. Use an editor/assembler or T-BUG itself to enter the machine code from the listing. If you have an editor/assembler, follow the steps below. (Substituting T-BUG should present no real problem, short of bleary-eyed boredom.)

```
16B0  C4454853  5452C445  46494E54  C4454853  *.EFSTR.EFINT.EFS*
16C0  4E47C445  4644424C  CC494E45  C5444954  *NG.EFDBL.INE.DIT*
16D0  C552524F  52D24553  554D45CF  5554CF4E  *.RROR.ESUME.UT.N*
16E0  CF50454E  C849454C  44C74554  D05554C3  *.PEN.IELD.ET.UT.*
16F0  4C4F5345  CC4F4144  CD455247  45CE414D  *LOSE.OAD.ERGE.AM*
1700  45CB494C  4CCC5345  54D25345  54D34156  *E.ILL.SET.SET.AV*
1710  45D35953  54454DCC  5052494E  54C44548  *E.YSTEM.PRINT.EF*
1720  D04F4B45  D052494E  54C34F4E  54CC4953  *.OKE.RINT.ONT.IS*
1730  54CC4C49  5354C445  4C455445  C155544F  *T.LIST.ELETE.UTO*
1740  C34C4541  52C34C4F  4144C353  415645CE  *.LEAR.LOAD.SAVE.*
1750  4557D441  4228D44F  C84ED553  494E47D8  *EW.AB..O.N.SING.*
1760  41525054  52D55352  C5824CC5  5252D354  *ARPTR.SR.RL.RR.T*
1770  52494E47  24C94E53  5452D04F  494E54D4  *RING..NSTR.OINT.*
```

#

COMMAND ENTERED TO GET THE ABOVE SCREEN: D 16B0

Example 2.

Step 1: Enter the source code in Listing 1 into the editor/assembler. Create a System Tape and save the source code on tape too. Note that the ORG statement is at 4A00H. This starts the additional code after T-BUG ends.

Step 2: Load T-BUG.

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Step 3: Load the new System Tape.

Step 4: The next step is kind of cute. We have to modify T-BUG itself by using T-BUG. T-BUG must be able to branch into our new code.

In T-BUG, the code between 43E5H and 4408H is checking for keyboard input of one of the T-bug commands: F,B,M,J,R,G, P or L. At 43E5H, the code is checking for an F, and branches to 480DH if an F was entered:

```
# M 43E5 FE C3
 43E6 46 06
 43E7 CA 4A
 43E8 OD 00
 43E9 48 00
#
```

Example 3.

```
43E5 FE46    CP   'F'
43E7 CA0D48  JP   Z,480DH
```

This code should be replaced with an unconditional branch to our new code, as below:

```
43E5 C3064A  JP   4A06H
43E8 00      NOP
43E9 00      NOP
```

To actually accomplish this, use the M command, as shown in Example 3. Be careful to get it right the first time. If you mess up before you finish entering C3064A, you will hang T-BUG up and have to reload it.

You might want to check address 4A06H to make sure the new code got there safely, before you alter T-BUG at 43E5H and go branching unconditionally into the hinterlands.

Step 5: Test all of the T-BUG commands. Once you have a good version of T-BUG+, then save it to tape with the P command:

```
P 4380 4B90 4380 T BUG
```

That's all there is.

To add your own commands is easy. Insert the compares and branches at line 240 in the same manner. Use the following T-BUG subroutines to save space:

4532H: Displays the contents of the A register at the current screen position. (The current screen address is stored in 483DH - 483EH.)

4589H: Retrieves two ASCII digits from the keyboard, displays them on the screen, using the current screen address as in the above routine, and returns the hex value in the A register.

One additional benefit from these routines is that the D and S command can be terminated in the same manner as the J command, by entering an X.

The final touch you might want to add is to literally put the + in your new T-BUG. That is, change the # symbol to a + symbol.

Locations 43DDH-43DEH load the A register with 23H (or #). To change the symbol, alter location 43DEH to contain 2BH (or +).■

Program Listing 1.

```
4A00            00010          ORG     4A00H
                00020 ;*************************
                00030 ;** TBUG+  JAN. 01,1980 **
                00040 ;*************************
43DD            00050 RETURN   EQU     43DDH
3C00            00060 VIDEO    EQU     3C00H
0001            00070 COUNT    DEFB    1
0001            00080 BLOCK    DEFB    1
0002            00090 SVMEMA   DEFS    2
0002            00100 SVSCRA   DEFS    2
                00110
4A06 FE43       00120 START    CP      'C'
4A08 2811       00130          JR      Z,CLS
                00140
4A0A FE44       00150          CP      'D'
4A0C 2827       00160          JR      Z,DUMP
                00170
4A0E FE46       00180          CP      'F'
4A10 CA0D48     00190          JP      Z,480DH ;ADD FIX RTN CHECK
                00200
4A13 FE53       00210          CP      'S'
4A15 CA014B     00220          JP      Z,SHIFT
                00230
                00240 ;INSERT ADDIT'L COMMANDS HERE.......
                00250
4A18 C3EA43     00260          JP      43EAH ;RET-NO HIT
                00270
                00280 ;*************************
                00290 ;** CLEAR SCREEN ROUTINE **
                00300 ;*************************
4A1B CD274A     00310 CLS      CALL    CLRSCR
                00320
4A1E 21003C     00330          LD      HL,VIDEO
4A21 223D48     00340          LD      (483DH),HL
                00350
4A24 C3DD43     00360          JP      RETURN
                00370
4A27 21003C     00380 CLRSCR   LD      HL,VIDEO
4A2A 11013C     00390          LD      DE,VIDEO+1
4A2D 010004     00400          LD      BC,400H
4A30 3620       00410          LD      (HL),20H
4A32 EDB8       00420          LDIR
4A34 C9         00430          RET
                00440
                00450 ;*************************
                00460 ;** DUMP MEMORY ROUTINE  **
                00470 ;*************************
                00480
4A35 CD3245     00490 DUMP     CALL    4532H
4A38 CD8945     00500          CALL    4589H
4A3B 324846     00510          LD      (4848H),A
                00520
4A3E CD8945     00530          CALL    4589H
4A41 323F48     00540          LD      (483FH),A
                00550
4A44 CD274A     00560          CALL    CLRSCR
                00570
4A47 DD2A3F48   00580          LD      IX,(483FH) ;MEM LOCN
4A4B FD21003C   00590          LD      IY,VIDEO ;SCR LOCN
4A4F 01D003     00600          LD      BC,3D0
                00610
4A52 AF         00620          XOR     A
4A53 32004A     00630          LD      (COUNT),A
4A56 32014A     00640          LD      (BLOCK),A
4A59 DD22026A   00650          LD      (SVMEMA),IX
4A5D FD22044A   00660          LD      (SVSCRA),IY
4A61 CD774B     00670          CALL    ADDRSS
                00680
4A64 FD23       00690          INC     IY
                00700
4A66 DD7E00     00710 DSPDMP   LD      A,(IX)
                00720
4A69 CD674B     00730          CALL    DSPRTN
                00740
                00750 ;ASCII CODE RTN
                00760
4A6C FDE5       00770          PUSH    IY
                00780
4A6E DDE5       00790          PUSH    IX      ;CURR MEM PTR
4A70 E1         00800          POP     HL
                00810
4A71 ED5B026A   00820          LD      DE,(SVMEMA)
4A75 B7         00830          OR      A
4A76 ED52       00840          SBC     HL,DE
                00850
4A78 ED5B044A   00860          LD      DE,(SVSCRA)
4A7C 19         00870          ADD     HL,DE
                00880
4A7D 112E00     00890          LD      DE,2EH
4A80 19         00900          ADD     HL,DE
                00910
4A81 E5         00920          PUSH    HL
4A82 FDE1       00930          POP     IY
                00940
4A84 3E2E       00950          LD      A,'.'
4A86 FD7700     00960          LD      (IY),A
                00970
4A89 DD7E00     00980          LD      A,(IX)
                00990
4A8C FE30       01000          CP      30H
4A8E FA994A     01010          JP      M,ASCEND
                01020
4A91 FE5B       01030          CP      5BH
4A93 F2994A     01040          JP      P,ASCEND
                01050
4A96 FD7700     01060          LD      (IY),A
                01070
4A99 FDE1       01080 ASCEND   POP     IY
                01090
4A9B DD23       01100          INC     IX
4A9D 0B         01110          DEC     BC
                01120
4A9E 3A004A     01130          LD      A,(COUNT)
4AA1 3C         01140          INC     A
4AA2 32004A     01150          LD      (COUNT),A
4AA5 FE04       01160          CP      4
4AA7 2803       01170          JR      Z,SPACE
4AA9 C3664A     01180          JP      DSPDMP
                01190
4AAC FD23       01200 SPACE    INC     IY
4AAE AF         01210          XOR     A
4AAF 32004A     01220          LD      (COUNT),A  ;CLEAR  COUNT
                01230
4AB2 3A014A     01240          LD      A,(BLOCK)
4AB5 3C         01250          INC     A
4AB6 32014A     01260          LD      (BLOCK),A
                01270
4AB9 FE04       01280          CP      4
4ABB 20A9       01290          JR      NZ,DSPDMP
                01300
4ABD AF         01310 NEWLIN   XOR     A
4ABE 32014A     01320          LD      (BLOCK),A  ;CLEAR BLOCK
                01330
4AC1 111700     01340          LD      DE,0017H
4AC4 FD19       01350          ADD     IY,DE
4AC6 FD22044A   01360          LD      (SVSCRA),IY
4ACA DD22024A   01370          LD      (SVMEMA),IX
4ACE 78         01380          LD      A,B
4ACF B1         01390          OR      C
4AD0 2807       01400          JR      Z,DSPRET
                01410
```

Program continues

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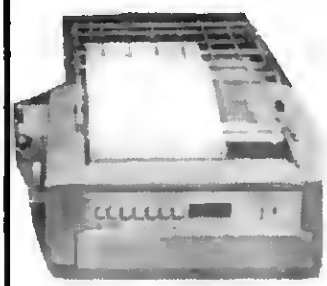

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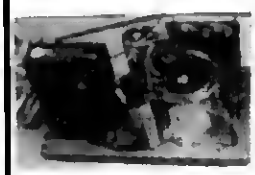

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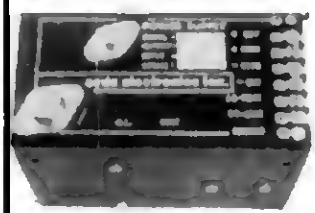

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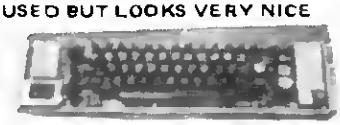

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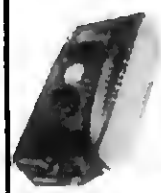

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```
4AD2 CD774B   01420          CALL    ADDRSS
              01430
4AD5 FD23     01440          INC     IY
4AD7 188D     01450          JR      DSPCMP
              01460
4AD9 213B3F   01470 DSPRET   LD      HL,3F3BH
4ADC 223D4B   01480          LD      (4B3DH),HL
4ADF C3DD43   01490          JP      RETURN
              01500
4AE2 4F       01510 DSPCHR   LD      C,A
4AE3 CB3F     01520          SRL     A
4AE5 CB3F     01530          SRL     A
4AE7 CB3F     01540          SRL     A
4AE9 CB3F     01550          SRL     A
4AEB CDF74A   01560          CALL    CHECK
4AEE 47       01570          LD      B,A
4AEF 79       01580          LD      A,C
4AF0 E60F     01590          AND     0FH
4AF2 CDF74A   01600          CALL    CHECK
4AF5 6F       01610          LD      L,A
4AF6 C9       01620          RET
4AF7 C630     01630 CHECK    ADD     A,30H
4AF9 FE3A     01640          CP      3AH
4AFB FA0048   01650          JP      M,CHECK1
4AFE C607     01660          ADD     A,7
4B00 C9       01670 CHECK1   RET
              01680
              01690 ;**********************
              01700 ;** MOVE UP/DOWN  ROUTNE **
              01710 ;**********************
              01720
4B01 CD3245   01730 SHIFT    CALL    4532H
              01740
4B04 CD8945   01750          CALL    4589H
4B07 324248   01760          LD      (4842H),A       ;SOURCE-MSB
              01770
4B0A CD8945   01780          CALL    4589H
4B0D 324148   01790          LD      (4841H),A       ;SOURCE-LSB
              01800
4B10 CD7B45   01810          CALL    457BH
              01820
4B13 CD8945   01830          CALL    4589H           ;DEST-MSB
4B16 324448   01840          LD      (4844H),A
              01850
4B19 CD8945   01860          CALL    4589H
4B1C 324348   01870          LD      (4843H),A       ;DEST-LSB
              01880
4B1F CD7B45   01890          CALL    457BH
              01900
4B22 CD8945   01910          CALL    4589H
4B25 324648   01920          LD      (4846H),A       ;#BYTES - MSB
              01930
4B28 CD8945   01940          CALL    4589H
4B2B 324548   01950          LD      (4845H),A       ;#BYTES - LSB
              01960
4B2E 2A4148   01970          LD      HL,(4841H)
4B31 ED5B4348 01980          LD      DE,(4843H)
4B35 B7       01990          OR      A               ;RESET CARRY
4B36 ED52     02000          SBC     HL,DE
4B38 F24D4B   02010          JP      P,MOVDWN
              02020
4B3B CD554B   02030 MOVUP    CALL    MSETUP
4B3E E5       02040          PUSH    HL
4B3F D5       02050          PUSH    DE
4B40 E1       02060          POP     HL
4B41 09       02070          ADD     HL,BC
4B42 E5       02080          PUSH    HL
4B43 D1       02090          POP     DE
4B44 E1       02100          POP     HL
4B45 09       02110          ADD     HL,BC
4B46 2B       02120          DEC     HL
4B47 1B       02130          DEC     DE
4B48 EDB8     02140          LDDR
4B4A C3DD43   02150          JP      RETURN
4B4D CD554B   02170 MOVDWN   CALL    MSETUP
              02180
4B50 EDB8     02190          LDIR
              02200
4B52 C3DD43   02210          JP      RETURN
4B55 213B3F   02220 MSETUP   LD      HL,3F3BH
4B58 223D4B   02230          LD      (4B3DH),HL
              02240
4B5B 2A4148   02250          LD      HL,(4841H)
4B5E ED5B4348 02260          LD      DE,(4843H)
4B62 ED4B4548 02270          LD      BC,(4845H)
              02280
4B66 C9       02290          RET
              02300
4B67 C5       02310 DSPRTN   PUSH    BC
4B68 CDB24A   02320          CALL    DSPCHR
4B6B C1       02330          POP     BC
              02340
4B6C FD7400   02350          LD      (IY),H
4B6F FD23     02360          INC     IY
              02370
4B71 FD7500   02380          LD      (IY),L
4B74 FD23     02390          INC     IY
              02400
4B76 C9       02410          RET
              02420
4B77 DDE5     02430 ADDRSS   PUSH    IX
4B79 D1       02440          POP     DE
              02450
4B7A 7A       02460          LD      A,D
4B7B CD674B   02470          CALL    DSPRTN
              02480
4B7E 7B       02490          LD      A,E
4B7F CD674B   02500          CALL    DSPRTN
              02510
4B82 3E2A     02520          LD      A,'*'
4B84 FD7729   02530          LD      (IY+29H),A
4B87 FD773A   02540          LD      (IY+3AH),A
              02550
4B8A C9       02560          RET
              02570
0000          02580          END
00000 TOTAL ERRORS
```

Here is a system-level software patch for 80's with sensitive ears.

Up and Down

M. Parris
646 Island Park Drive
Ottawa, Ontario
Canada K1Y 0B7

The TRS-80 has an annoying feature—its sensitivity to input volume. While you can rerecord a BASIC program into an acceptable volume level, this cannot be done with machine language tapes.

The short BASIC program in Listing 1 lets you rerecord any 500 baud A5 tape (as used in the TRS-80 Level II system) cleanly onto a new cassette, and so eliminate all of that fumbling around with volume levels. The program simply loads (from the DATA statement) two short machine routines.

You call the first routine by typing R; it fills an 8K buffer from the cassette input, an adequate size for practically any tape that might be encountered.

The second is called by typing W; it dumps this buffer onto a new tape. The first ten bytes are written slowly, which allows time for the eventual loader program to organize itself.

The program is written for a 16K system and an 8K buffer, but you can adapt it for a 4K system or a larger/smaller buffer. For example, changing DATA items 6 and 35 from 32 to 4 will provide a 1K rather than an 8K buffer, which speeds up the processing of small tapes. I've provided Listing 2 for more extensive changes.

Note that no checksum determination is made.■

```
1 FOR I=20480TO20545:READJ:POKEI,J:NEXTI:POKE16527,80
2 AS=INKEY$:IFA$="R"THENPOKE16526,22ELSEIFA$="W"THEN
POKE16526,23ELSEIFA$<>""THENSTOPELSEGOTO2
3 PRINTA$:I=USR(0)
4 DATA33,66,80,1,0,32,175,205,18,2,205,150,2,205,53,2,
119,205,55,80,24,247,175,205,18,2,205,135,2,33,66,80,1,
0,32,17,10,0,123,180,40,4,29,21,32,253,126,205,100,2,
205,55,80,24,239,35,11,120,177,192,205,248,1,195,25,26
```

Listing 1.

```
                00100 ;REREC@RD A TRS-80 '45' TAPE
5000            00110         @RG 5000H
5000 214250     00120 READT   LD HL,START     ;STORE BEGINS HERE
5003 010020     00130         LD BC,SIZE      ;SIZE OF STORE = 8K
5006 AF         00140         XOR A
5007 CD1232     00150         CALL 212H       ;TAPE DRIVE ON
500A CD9632     00160         CALL 296H       ;LOOK FOR SYNC
500D CD3502     00170 MORER   CALL 235H       ;READ A BYTE
5010 77         00180         LD (HL),A       ;STORE THE BYTE
5011 CD3750     00190         CALL TEST       ;ANY ROOM LEFT?
5014 18F7       00200         JR MORER        ;YES, KEEP ON
5016 AF         00210 WRITET  XOR A
5017 CD1202     00220         CALL 212H       ;TAPE DRIVE ON
501A CDA702     00230         CALL 287H       ;WRITE LEADER & SYNC
501D 214250     00240         LD HL,START     ;LOOK FOR 1ST BYTE
5020 010020     00250         LD BC,SIZE
5023 110400     00260         LD DE,04H       ;WAIT COUNTERS
5026 7B         00270 MOREW   LD A,E          ;GET BYTE COUNTER
5027 B7         00280         OR A            ;ZERO?
5028 2804       00290         JR Z,NOWAIT     ;YES, FULL SPEED
502A 1D         00300         DEC E           ;NO, DEC COUNTER
502B 15         00310 WAIT    DEC D           ;TIMING LOOP
502C 20FD       00320         JR NZ,WAIT      ;HO-HUM !
502E 7E         00330 NOWAIT  LD A,(HL)       ;GET THE BYTE
502F CD6402     00340         CALL 264H       ;WRITE THE BYTE
5032 CD3750     00350         CALL TEST       ;END OF STORE?
5035 18EF       00360         JR MOREW        ;NO, KEEP ON
5037 23         00370 TEST    INC HL          ;NEXT LOCATION
5038 0B         00380         DEC BC          ;DEC COUNTER
5039 78         00390         LD A,B          ;ZERO YET?
503A B1         00400         OR C            ;BOTH B & C
503B C0         00410         RET NZ          ;NO, KEEP ON
503C CDF801     00420         CALL 1F8H       ;YES, TAPE DRIVE OFF
503F C3191A     00430         JP 1A19H        ;BACK TO BASIC
5042            00440 START EQU $             ;BUFFER STARTS HERE
2000            00450 SIZE EQU 2000H          ;TAPE 8K MAXIMUM
                00460                         ;AFTER SYNC BYTE
                00470 ;THAT'S ABOUT 80 ON TAPE COUNTER
0000            00480         END
00000 TOTAL ERRORS

WAIT    502B
NOWAIT  502E
MOREW   5026
WRITET  5016
TEST    5037
MORER   5000
SIZE    2000
START   5042
READT   5000
```

Listing 2.

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Prices include Percom upgrade PATCHPAK™

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This PC board plug-in adapter for the TRS-80* virtually eliminates data read errors (CRC error — Track locked out!) which occur on high density inner disk tracks, a problem that has plagued TRS 80* systems. The Percom Data Separator™ is installed in the Expansion Interface without modifying the host system. Caution: Opening the TRS-80* Expansion Interface may void the limited 90-day warranty. $29.95

Percom OS-80™

An advanced easy-to-use disk operating system that works with Level II BASIC commands. Resides in only 7-Kbyte of memory. May be extended indefinitely with disk-resident utilities. Supplied on 5" disk with example programs: $29.95 with instructions.

CIRCLE J Software

Two extremely useful utilities for Percom's OS-80™ DOS:

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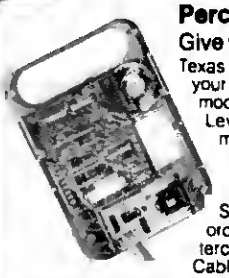
Use MAILFORM to create name and address lists; EXTRACT to find names by ZIP, address, gender, age, etc.; SORT to sort an entire list on any field in seconds. Print personalized letters written with either the Electric Pencil‡ or Scripsit* using MAILRITE. Prints labels from Mailfile created under MAILFORM. Runs under Percom's OS-80™, Radio Shack's TRSDOS* $125 (disk).

Inexpensive Color Graphics: the Percom Electric Crayon™

Spectecular multicolor graphics, sharp 2-color alphanumerics with your TRS-80*, a color tv and the Percom Electric Crayon™. Up to eight colors. Resolution with full display memory (6 Kbytes) is 256 X 192 picture elements. Microprocessor controlled, the Electric Crayon™ is not only a full color graphics system but also a complete, self-contained control computer with a dual bidirectional parallel I/O port — provision for second dual port. Interface the TRS-80* via your Expansion Interface or Printer Cable Adapter. Supplied with 1 Kbyte display RAM, EGOS™ operating system and comprehensive users manual with example programs. $249.95

Optional TRS-80* interconnecting cable $24.95

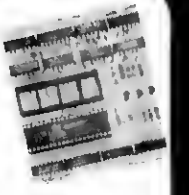
Percom's Speak-2-Me-2™



Give your TRS-80* the gift of speech

Texas Instruments' Speak & Spell™ is the voice of your TRS-80* computer with this clever interface module manufactured by Percom. Your own Level II BASIC programs announce, command, implore with sentences and expressions formed from Speak & Spell's™ vocabulary. The Speak-2-Me-2™ PC module installs in the battery compartment of your Speak & Spell™. Power is supplied from an ordinary calculator power pak. Comes with interconnecting cable (for TRS-80* EI or Printer Cable Adapter), operating software and users manual: $69.95. (Speak & Spell™ not included.)

the DOUBLER™



Percom's new plug-in adapter for your Expansion Interface stores almost twice the data on a diskette track as a single-density system. You can store up to four times more data — depending on the type of drive — on one side of a diskette than you can store using a standard Model I mini-disk drive. Other features: Reads, writes and formats *either* single or double density minidiskettes • Runs TRSDOS* NEWDOS +, Percom OS-80™ or other single density software *without* changing either software or hardware. Switch to double-density when convenient • Includes DBLDOS™ a TRSDOS* compatible double-density operating system • Includes on card high-performance data separator circuit • Installs *without* rewiring or trace cutting • Introductory price including DBLDOS and format conversion utility only $219.95. Mention our DOUBLE DISCOUNT NUMBER when you order and save $20.00 on your DOUBLER!

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DISCONTINUED

Cable (Printer to TRS-80* computer) $34.95

Disk System Interconnecting Cables

Improvement over RS cable design places drive 0, which includes the cable termination, at the end of the cable to eliminate the reflected noise of an unterminated cable. Better data integrity. Prices:

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Single Disk 3.49

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* trademark of Texas Instruments Corporation
‡ trademark of Michael Shrayer Software, Inc

See ever-changing patterns in 500 bytes.

The Random Walker

John F. Strazzerino
150 Dundee Dr.
South S.F., CA 94080

This amusing Level II program uses TRS-80 graphics to draw an ever-changing pattern before your eyes. After a specified amount of time, the screen is erased and a new pattern is drawn, with different starting points and spacing between points.

The main coordinates X and Y are chosen. The spaces between the dots for the X and Y coordinates are called X1 and Y1. The X coordinate is checked to see if it's an even multiple of X1. If not, 1 is subtracted from X until X is an even multiple of X1. The same is done for the Y coordinate.

The point at the screen location specified by (X,Y) is lit. A random number is chosen and, depending on it's value, one of four directions, right, left, down or up, is chosen, and the appropriate coordinate is altered. If the resulting movement is the lighting of a point outside the range of the TRS-80 screen, a new starting point is chosen, and the process begins again. The above rules apply once for each iteration of the program loop in line 1500.

The logic is simple and there are many ways to alter it. For example, add the line shown in Example 1, and the number of iterations will be shown in the lower right-hand side of the screen. The code in Example 2 resets the point if it is lit and sets the point if it is not lit. Example 3 contains BASIC statements to list the X and Y increments used. Example 4 gives a way to start a drawing over before the loop in line 1500 has completed.

Even though multiple BASIC statements per line are not used, the program still takes less than 500 bytes. It is also easily convertible into Level I BASIC. ■

```
3150 PRINT @1017 Z%
```

Example 1.

```
3050 IF POINT(X,Y) THEN RESET(X,Y):
     GOTO 3200
```

Example 2.

```
1450 PRINT @970,"X INCREMENT = ";X1;
1475 PRINT @990,"Y INCREMENT = ";Y1,
```

Example 3.

```
1550 Y$ = INKEY$
1560 IF Y$ = ""THEN 1600
1570 GOTO 1100
```

Example 4.

```
1100 CLS
1200 RANDOM
1300 Y1=RND(2)
1400 X1=RND(3)
1500 FOR Z%=1 TO 500
1600 IF Z%<>1 THEN 2500
1700 X=RND(127)
1800 Y=RND(47)
1900 IF X/X1 = INT(X/X1) THEN 2200
2000 X=X-1
2100 GOTO 1900
2200 IF Y/Y1 = INT(Y/Y1) THEN 3100
2300 Y=Y-1
2400 GOTO 2200
2500 ON RND(4) GOTO 2600 ,2700 ,2800 ,2900
2600 X=X+X1:GOTO 3000
2700 X=X-X1:GOTO 3000
2800 Y=Y+Y1:GOTO 3000
2900 Y=Y-Y1:GOTO 3000
3000 IF X<0 OR Y<0 OR X>127 OR Y>47 THEN 1700
3100 SET (X,Y)
3200 NEXT Z%
3300 GOTO 1100
```

Program Listing 1.

See how to format your Quick Printer's output to effectively display video graphics.

The Long and The Short of It

Albert C. Bole, Jr.
224 Jupitar Drive
WSMR, NM 88002

The TRS-80 Quick Printer is a versatile little machina—but it lacks an inherent capability to print graphics displayed on the TRS-80 video monitor. Moreover, tha narrow width of the Quick Printar paper may seem to be a bar to reproducing graphics.

The following program shows you how to print graphics that result in a bettar graph than the one displayed.

Two equations will be used on the TRS-80 vidao monitor to illustrate the program:

$$x^3/350 - x^2/50 - 10x/7 = y$$
and
$$38x/127 = y.$$

They will show you three elements of graphic display: curves, near-vertical lines and naar-horizontal lines.

Two Problems

There are two problems essociated with rapresenting graphics on the Quick Printer: scaling, and the stap-like blocks that reprasent linee et an angle on the TRS-80 video monitor.

Let's take a look at the scaling problem first. Fig. 1 shows the way the curves would look if they were graphed with one unit on the horizontal axis having the same length as one unit on the vertical axis—pretty much the same way we laarned in algebra or analytic geometry.

The scale on the TRS-80 video monitor is about two units on the horizontal scale equel to one unit on the vertical scale. Fig. 2 shows how the curvas would look on tha video monitor. Note that the curves are compressed on the vertical axis. Nothing is wrong in that, but it gives a diffarent appearance than what we ara used to, and can make the graph more difficult to read.

In the November 1979 issue of the *Radio Shack Microcomputer Newsletter*, a program to print graphics on tha Quick Printer is listed. The program uses the

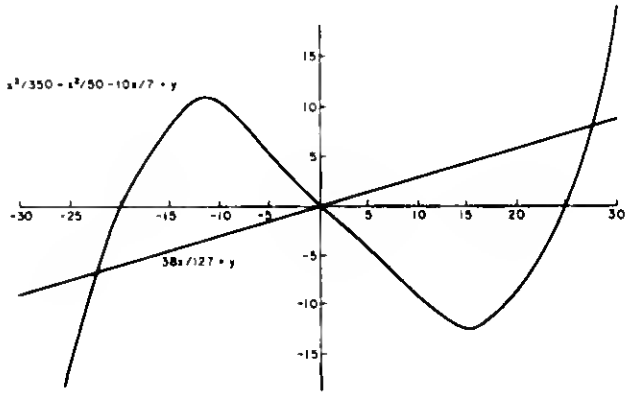


Fig. 1. Convantional Graph

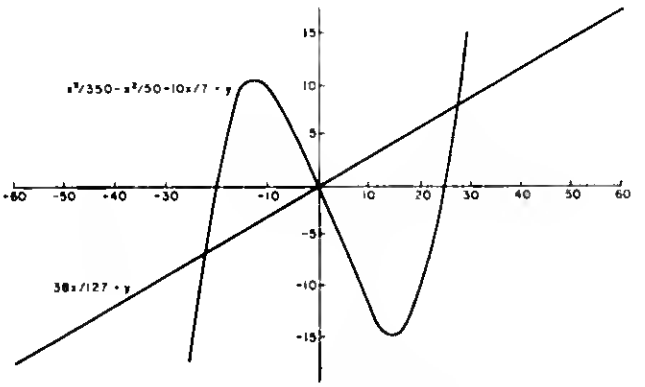


Fig. 2. Graph on TRS-80 Video Monitor.

★★★ A PERCOM BULLETIN ★★★ ↙409

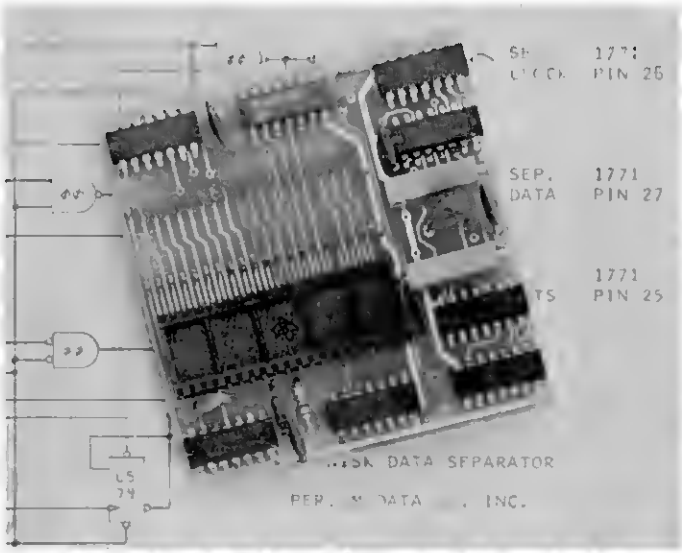
Adapter for TRS-80* computer eliminates disk read errors

Garland, Texas — Harold Mauch, president of Percom Data Company, announced that the company is marketing a simple plug-in adapter for TRS-80* computers that corrects a dasign deficiency in the disk controller circuit.

The problem, which causes disk raad errors, has been traced to Tandy's reliance on a circuit internal to the FD1771 controller IC to perform the function of separating clock and data pulses.

As explained in the *Backgrounder*, use of the internal chip circuit for reliable data-clock separation is a design shortcut which the manufacturer of the controller IC warns against.

The Percom solution, a PC card adapter called the SEPARATOR™, eliminates the problem by substituting an explicit data separator circuit — one which has been used reliably in Percom disk controllers since 1977 — for the internal IC separator circuit.



Percom adapter fixes TRS-80 computer disk controller.*

The SEPARATOR™ is installed without modifying the host system. The user merely removes the FD1771 IC from the host controller, installs the IC in the DIP socket on the SEPARATOR™ card, and plugs the adapter into the vacated socket of the host controller.

Percom cautions that opening the Expansion Interface of the TRS-80* computer, which is required to install the SEPARATOR™, may void the computer's limited 90-day warranty.

The SEPARATOR™, which sells for $29.95, may be purchased from Percom dealers or ordered direct from the factory. The Percom toll-free order number is 1-800-527-1592.

Payment for mail orders may be made by certified check, cashier's check or money order, or charged to a Master Card or VISA account. Texas residents must add 5% sales tax.

Percom Mini-Disk Drives Store More, Cost Less. ↙408

Percom mini-disk drives store more data, are more reliable, yet a 40-track Percom drive costs **$100.00 less** than a 35-track Tandy drive.

You can store over 102 Kbytes per disk on Percom TFD-100™ 40-track drives, over 197 Kbytes per disk on TFD-200™ 77-track drives. A patch — supplied free on minidisketta — upgredes TRSDOS* for operation with the newer 40- and 77-track drives.

Both TFD-100™ and TFD-200™ models are available in one-, two- and three-drive configurations.

Prices start at $399 for a single-drive TFD-100™, $675 for a single-drive TFD-200™. Drives are supplied with heavy-duty power supplies. Metal enclosure is finished in compatible silver enamel.

See your nearby Percom dealer or order direct by calling toll-free 1-800-527-1592.

Five-Inch Disks Store More Than Eight-Inch Disks! ↙1

Garland, Texas — June 25, 1980 — Percom Data Company has begun production of a double-dansity disk controller adapter for TRS-80* Model I computers.

Harold Mauch, president of Percom, made that announcement here today, saying that data storage capecity using the adapter and double-density disk operating system — which is included — can be increased to as much as 354 Kbytes per minidiskette.

By comparison, the maximum storage for larger eight-inch disk systems used with the TRS-80* Model I computer is about 290 Kbytes.

Mauch said the PC card adapter, which plugs into the controller chip socket of the computer Expansion Interface, works equally well for aither single-density or double-density storage, and users may continue to run programs under TRSDOS*, OS-80™ and other single-density operating systems with the adapter installed.

Price, for the plug-in adapter, the TRSDOS*-like double-density DOS and a utility for converting files and programs from single- to double-density format is $219.95.

BACKGROUNDER

CRC ERROR! TRACK LOCKED OUT!

by the Technical Staff
Percom Data Company ↙410

This problam started while we were studying an annoying problem with the TRS-80* computer. Disk drives sold by Percom are realigned and tested before shipment. We noticed, however, that some disk drives would pass the Percom inspection but just would not work reliably on the inner tracks with a TRS-80* computer. These drives were within the manufacturer's specifications, and would function perfectly on other disk systems Percom manufactures — "perfectly" here meaning more than 50 million bytes read without error!

The disk read data separation arrangement in the TRS-80* computer Expansion Interface uses an internal data separator of the FD1771 disk formatter/controller IC. Use of the FD1771 internal data separator is not recommended by Western Digital, the IC manufacturer. The following note appears on page 17 of the FD1771 data sheet:

> Internal data separetion may work for some applications. However, for applications requiring high data recovery reliability, WDC recommends external data separation be used.

We suepected tha data separator because the problem was most severe on disk inner tracks where storage density is highest and data seperation is most critical.

To prove our point, a technician braadboarded a standard Percom data separator circuit, and configured it to plug directly into the FD1771 IC socket of the TRS-80* computer controller.

When connected to the TRS-80* computer, a troublesome drive functioned perfectly! We ran a BACKUP utility many times and never got a track lockout. Before we added the external data separator circuit to the computer, this same drive would always lock out tracks, and would heve difficulty reading from the inner (higher number) tracks.

The Percom data separator circuit fixes the mini-disk controller of the TRS-80* computer. The type of drives being used is irrelevant; the circuit eliminatas disk read errors resulting from the inability of the Tandy controller design to reliably separate clock and data signals when reading high density inner tracks.

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TRS 80

ROM
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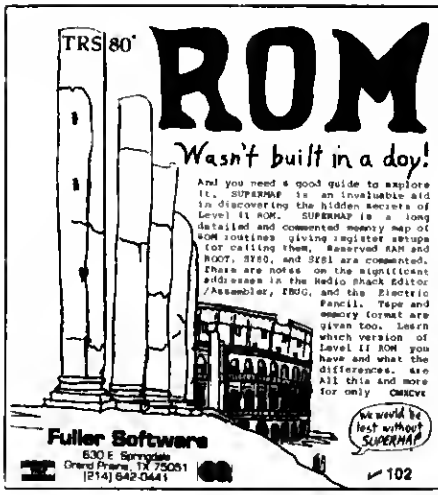

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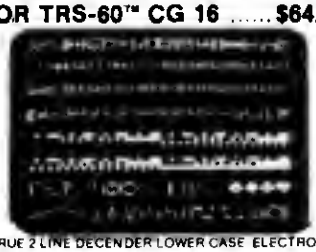

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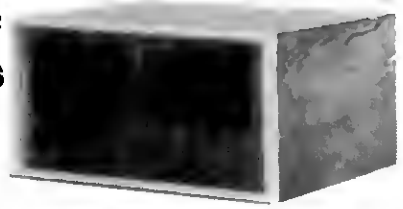

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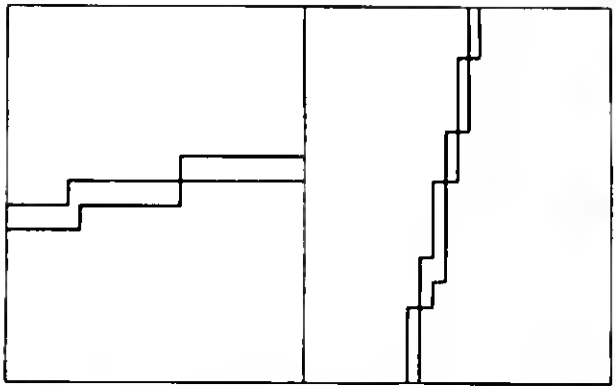

Fig. 4. Near-horizontal Line on Video Monitor (on left) and Near-vertical Line.

width of the Quick Printer paper (approximately 4.75 inches) as the horizontal axis. It compensates for the 80 characters per line, compared with 128 spaces on the horizontal axis of the video monitor, by compressing 1.6 spaces of video into one line character on the Quick Printer.

This works all right, but the curves are further compressed about the vertical axis. Now seven units on the horizontal axis equal one unit on the vertical axis. This is shown in Fig. 3.

My solution is to use the width of the Quick Printer paper as the vertical axis and the length of the paper as the horizontal axis. This corresponds roughly with the 48 by 128 matrix on the video monitor.

Now, if I let one line character represent one unit on the vertical axis, with one line representing a unit on the horizontal

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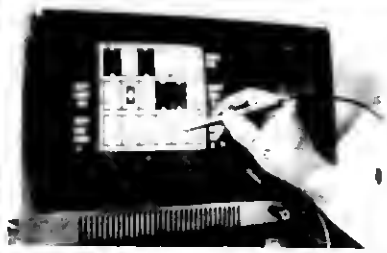

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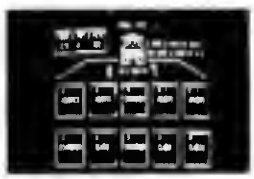

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axis, the result will be a graph with the curves compressed about the horizontal axis.

To solve that, I use the 40 character/line option CHR$(30) and the 80 character/line option CHR$(29). With them I print every other column from the TRS-80 video monitor (step 2 in line 122). This has the disadvantage of using only 37 out of the 48 video monitor lines, but it results in a more legible graph.

So much for scaling. The TRS-80 video monitor presents any lines or curves that are not vertical or horizontal as a series of blocks, much like stair steps. Fig. 4 shows how lines close to the horizontal and how lines close to the vertical appear on the video.

Lines 170 and 171 in the Program Listing are designed to eliminate extra +'s on near-vertical lines. I tried putting in a similar routine to eliminate extra +'s for near-horizontal lines—and succeeded in eliminating so many that the graph was unintelligible!

The finished product is shown at Fig. 5. Note that it looks more like Fig. 1 than Fig. 2. It demonstrates that with some fitting to the particular curves being graphed, you can print a satisfactory representation of the video monitor display on the TRS-80 Quick Printer.■

```
>|
5 'THIS PROGRAM DISPLAYS THE
6 'EQUATIONS:
7 'X[3/35@-X[2/5@-1@*X/7=Y
8 'AND 3@*X/13@=Y FOR USE IN
9 'THE QUICK PRINTER PROGRAM.
1@ CLS
2@ X=63:FORY=@TO37:SET(X,Y):NEXTY
21 FORY=3TO37STEP5:RESET(X,Y):NEXTY
22 Y=1@:FORX=@TO127:SET(X,Y):NEXTX
23 FORX=3TO127STEP5:RESET(X,Y):NEXTX
3@ FORX=-63TO63STEP.2
4@ Y=1@-X[3/35@+X[2/5@+1@*X/7
5@ Z=X+63
6@ IF(Y>37)OR(Y<@)THEN65ELSESET(Z,Y)
65 A=1@-X*36/126:Z=X+63
66 IFA<@THEN7@ELSESET(Z,A)
7@ NEXTX
9@ 'QUICK PRINTER GRAPHICS
91 'BY A. C. BOLE, JR.
1@@ LPRINTCHR$(3@)"   -15  -1@   -5";
1@2 LPRINT"    @    5   1@   15"
11@ LPRINT"  ...*....*....*....*....*....";
112 LPRINT".*....*....*....*"
113 '1@@-112 LABEL THE VERTICAL AXIS.
12@ FORA=1TO127STEP2:A1=ABS(A-63)
122 IFA1<1@LPRINTCHR$(29)" ";A1;
124 IFA1>9LPRINTCHR$(29)A1;
125 '122-124 LABEL THE HORIZONTAL
126 'AXIS.  CHR$(29) USED SO AS TO
127 'TAKE UP AS LITTLE LINE SPACE AS
128 'AS POSSIBLE.  TWO LINE CHARAC-
129 'TERS MUST BE USED FOR EACH
13@ 'LINE FOR ACCURATE GRAPHING;
131 'HENCE THE " "; IN LINE 122.
14@ FORB=36TO@STEP-1
141 IFA=63THEN142ELSE15@
142 E=B+2
143 IFE/5=INT(E/5)THEN144ELSE146
144 LPRINTCHR$(3@)"*";:GOTO18@
146 LPRINTCHR$(3@)".";:GOTO16@
147 '144-146 PRINT VERTICAL AXIS.
15@ IFB=1@THEN152ELSE17@
152 IFA1/5=INT(A1/5)THEN144ELSE154
154 LPRINTCHR$(3@)" ";:GOTO18@
155 '154, 144 PRINT HORIZONTAL AXIS.
17@ IFPOINT(A,B)=-1THEN171ELSE177
171 IFPOINT(A,B+1)=-1THEN177
176 LPRINTCHR$(3@)"+";:GOTO18@
177 LPRINTCHR$(3@)" ";:GOTO18@
18@ NEXTB
181 LPRINT""
19@ NEXTA
2@@ GOTO2@@
381@ FORD=@TO47
3820 FORX=@TO127STEP1.6
3830 IFPOINT(X,D)=-1THENLPRINT"+";ELSELPRINT" ";
3850 NEXTX
3860 LPRINT""
3870 NEXTD
3880 GOTO3@@@
READY
>
>
```

Program Listing.

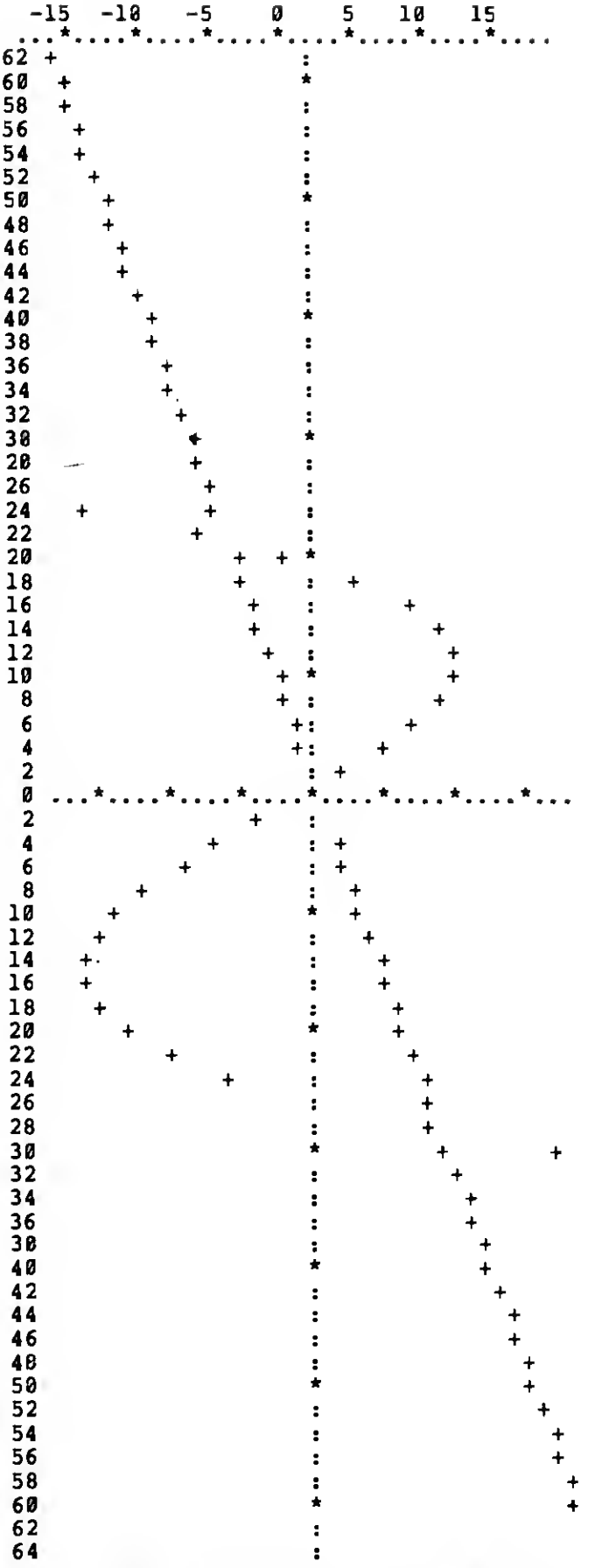

Fig. 3. Graph on Quick Printer with Width of Paper as Horizontal Axis.

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Load and run the program. Make sure that whoever is going to use the program knows these five things:

1. Push the Enter key after each answer.
2. Use the ← key to correct mistakes.
3. To prematurely stop the program, press the Break key.
4. Numbers are entered calculator fashion (with each new digit the number is shifted over and the new digit is put in the ones column).
5. There is a difference between zero and the letter O. The computer will not accept O for a number, only zero.

After you have typed Run there will be a short delay as the computer initializes the random numbers. It will then print a short introduction to get the students attention. It will ask which types of problems (+, −, ×, ÷) are wanted. You may choose more than one, but you must choose at *least* one. These four questions must be answered Yes or No.

The computer will then ask for a skill level number, which the student answers by entering a

Modification	Room required
One	14 bytes
Two	None
Three–Five	Total of 19 for all three, +/− approximately 25 bytes for each skill level added/deleted
Six	−333 bytes
Seven	−52 bytes
Eight	164 bytes
Nine	60 bytes

Negative numbers indicate a space saving modification.

Table 1. Memory Size Modification Table.

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Written in Z80 machine language, **SE** compares tens of thousands of characters in a few seconds. Simple commands add, change, or remove data entries. To search for entries, up to 64 characters can be combined as targets for immediate retrieval. **SE** occupies only 4K; the rest is storage and can be saved on tape or disk.

The tape version for 16K level II, SE2.0, is $24.95, while the disk version for DOS up to 48K, SE3.0, is $49.95. The price includes full documentation.

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3200 x 0,a,b,c,d,e,f

x = Skill level number
a = Maximum of first addition number
b = " second "
c = " answer (a + b). If the values randomly chosen for a and b would result in an answer greater than c, new values for a and b are chosen.
d = Maximum of first multiplication number
e = " second "
f = " answer (d * e)

The program creates subtraction problems from addition problems. The addition problem 3 + 5 = ? would become 6 – 5 = ? or 8 – 3 = ? for a subtraction problem. The same method is used for multiplication and division.

Fig. 1. Skill Level Modification

number between one and four. The easiest is level one and the degree of difficulty progresses through level four, which is quite difficult even for an adult.

At this point the computer clears the screen, draws the pattern that will be used in the game, and then begins the test.

Three Opportunities

Each problem is displayed in the middle of the screen. The student has three opportunities to answer each problem, after which the computer prints the answer on the screen. (By the way, if the picture on the screen is disturbed during the game, press the Break key and run the program again.)

Each time the student answers a problem correctly the computer updates the timer and may light up a message in the annunciator panel. The seconds on the timer are equal to the number of problems to be answered before the rocket takes off, plus ten.

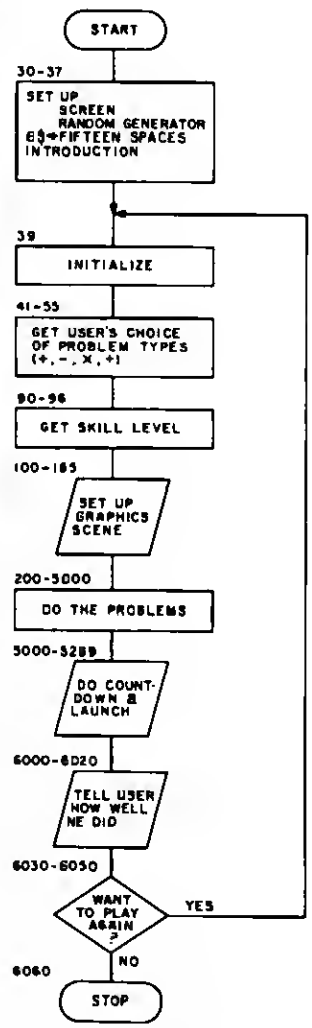
When the student correctly answers a certain number of problems the program simulates a count down, with the timer decrementing from ten to zero. At zero the rocket blasts off. After the visual display the student is told how well he did, by means of one of two computer messages. The message displayed depends upon the percentage of problems that were answered correctly on the first try.

Finally the program asks if the student wants to play again.

Customizing Ideas

For those of you who can't leave a good thing alone, I've included a few ideas for modifications.

Before you do any surgery make sure the entire patient is loaded into the computer. If you have only a limited amount of memory available, it is best to make sure there will be enough for all the changes you plan.



Flowchart 1. Master Flowchart

```
1 GOTO30
2 FORL=1TO500:NEXTL:RETURN
4 FORN=1TO9:D=D/10:IFD>=1NEXTN
5 RETURN
6 IFRND(0)>.5O=B:B=C:C=D
7 RETURN
30 CLS:B$="                "
31 PRINT"WELCOME TO":PRINT" ","M I S S I O N   C O N T
   R O L":PRINT
32 IFABS(A)>1E-34A=A/4:B=RND(0):GOTO32
33 PRINT" OUR COMPUTER HAS BROKEN DOWN.  YOU ARE OUR O
   NLY HOPE!"
34 PRINT"YOUR MISSION:  DO THE MATH PROBLEMS THE COMPUT
   ER USED TO DO."
35 PRINT:PRINT"  THERE ARE FOUR TYPES YOU CAN DO.  ADDI
   TION (+),"
36 PRINT"SUBTRACTION (-), MULTPLICATION (X), AND DIVISI
   ON (  )."
37 FORK=199TO195:SET(K,21):NEXTK:SET(188,22):PRINT
39 R=0:F=5:O=5:P=0:A=3:T=2:S=4
41 N=9:Y=1:RESTORE:L=0:FORJ=0TO3:READA$
50 PRINT"DO YOU WANT ";A$;:INPUTE:IFE*(E-Y)PRINT"YES OR
   NO":GOTO50
55 A(J)=E:L=L+E:NEXTJ:IFL=0PRINT"YOU HAVE TO DO SOMETHI
   NG.":GOTO41
90 PRINT"SKILL LEVEL (FROM 1 TO";S;". 1 IS EASIEST,";S;
   "IS HARDEST)";:INPUTE
93 IF(E-INT(E))+(E<1)+(E>5)GOTO90
97 N=P+E*A-A:FORP=1TOE:READU,V,N,X,Y,Z:NEXTP:IFP>5GOTO1
   00
98 FORO=1TO(S-P+1)*6:READB:NEXTO
100 CLS:FORK=2TO38STEP6:FORJ=2TO39:SET(J,K):SET(J,K+4):
    NEXTJ
110 FORJ=ETOK+4:SET(2,J):SET(39,J):NEXTJ:NEXTK
140 J=47:GOSUB39000:FORK=29TO47:FORJ=40TO51
145 SET(J,K):NEXTJ:NEXTK:FORK=52TO62:SET(K,31):SET(K,39
    ):SET(K,47):NEXTK
160 FORJ=102TO126:SET(J,2):SET(J,6):NEXTJ:FORJ=2TO6:SET
    (101,J)
165 SET(127,J):NEXTJ:PRINT@246,"TIMER";:PRINT@119,"9:";
    N+10;
200 I=9:FORJ=NTO1STEP-1:I=I+1
210 A=RND(U+1)-1:B=RND(V+1)-1:IFA+B>WGOTO210
220 C=RND(X+1)-1:N=RND(Y):IFC*N>ZGOTO220
230 D=A:GOSUB84:L=N:D=B:GOSUB4:IFN>LO=A:A=B:B=O
300 F=F*(F<4)+1:IFA(F-1)=0THEN399
400 ONFGOTO600,610,620,590
500 A=C*N:B=N:C=G:D=B:GOSUB4:PRINT@223-N,B;:D=A:GOSUB4:
    PRINT@226,A;
510 FORK=66TO69+2*N:SET(K,7):NEXTK:FORK=0TO10:SET(56,K)
    :NEXTK:GOTO900
600 C=A+B:A$="+":GOTO630
610 C=A:A=B+C:A$="-":GOSUB6:GOTO630
620 A=G:B=H:C=A*B:A$="X":D=A:GOSUB4:L=N:D=B:GOSUB4:IFN>
    LO=A:A=B:B=O
630 D=B:GOSUB4:PRINT@97-N,B;:D=A:GOSUB4:PRINT@33-N,A;
640 FORK=63-2*NTO67:SET(K,7):NEXTK:PRINT@94-N,A$;
900 PRINT@410,"THE ANSWER IS  ";:INPUTE:PRINT@410
1100 IFE=CR=R+1:K=0:PRINT@419,"RIGHT !!!":GOTO2300
1200 FORK=1TOT:PRINT@419,"WRONG.":GOSUB2
1410 PRINT@410,"TRY AGAIN. ANSWER IS  ";:INPUTE:PRINT@4
    10:IFE=CK=99
1799 NEXTK:IFK>0PRINT@410,"VERY GOOD!!":GOTO2300
2000 PRINT@410,"SORRY. YOUR GUESSES ARE UP.":J=J+1:GOSU
    B2
2010 PRINT@410:IFF=4PRINT@95,"^";:GOTO2300
2020 PRINT@416,"|"
2300 D=A:GOSUB4:L=N:D=C:GOSUB4:PRINT@225-N+(L-127)*(F=4
    ),C;
2399 FORL=1TO1500:NEXTL
2400 PRINT@119,"0:";J+9;
2500 L=INT((J-1)*5/M):IFL-QREADA$:PRINT@(4-L)*128+67,A$
    ;:O=L
5000 FORL=0TO6:PRINT@22+L*64,B$;:NEXTL:NEXTJ:READA$:FOR
    J=9TO0STEP-1
5100 PRINT@787,B$;:RESET(36,33):FORT=1TO250:NEXTT:PRINT
    @787,A$;:RESET(36,33)
5120 FORT=1TO250:NEXTT:PRINT@119,"0:0";J;:NEXTJ:PRINT@0
    38,"LAUNCH!";:RESET(26,39)
5200 O=47:FORJ=41TO-1STEP-6:GOSUB39000
5290 FORK=J+1TOO:FORL=0TO4:RESET(64+L,K):RESET(64-L,K):
    NEXTL
5294 RESET(57,K):RESET(71,K):RESET(55,K):RESET(73,K):NE
    XTK:FORK=J+1TOJ+10
5298 IFK<48SET(64,K):SET(63,K):SET(65,K)
5299 RESET(64,K):RESET(63,K):RESET(65,K):NEXTK:O=J:NEXT
    J:GOSUB2
6000 PRINT@410,"YOU TOOK";I;"TRIES TO GET"
6010 PRINT@475,N;"PROBLEMS RIGHT."
6011 PRINT@539,"YOU GOT";R;"RIGHT ON THE FIRST TRY.";PR
    INT@602;
6015 IF(R/I)>=.7PRINT"THE MISSION WAS A SUCCESS.":GOTO60
    30
6020 PRINT"THE ROCKET GOT LOST."
6030 FORL=1TO3500:NEXTL:PRINT@474;PRINT@539;PRINT@602:N
    =0:Y=1
6040 PRINT@410,"DO YOU WANT TO PLAY AGAIN";:INPUTE:CLS
6045 IFE*(E-Y)PRINT"YES OR NO":GOTO6040
6050 IFEGOTO30
6060 END
30000 FORK=J-19TOJ:IFK>=0SET(64,K)
30010 NEXTK:FORK=J-16TOJ:IFK>=0SET(63,K):SET(65,K)
30020 NEXTK:FORK=J-13TOJ:IFK>=0SET(62,K):SET(66,K)
30030 NEXTK:FORK=J-11TOJ:IFK>=0SET(61,K):SET(67,K)
30040 NEXTK:FORK=J-4TOJ:IFK>=0SET(60,K):SET(68,K)
30050 NEXTK:FORK=J-2TOJ:IFK>=0SET(57,K):SET(71,K)
30060 NEXTK:IFJ>=0SET(55,J):SET(73,J)
30070 RETURN
32000 DATA"ADDITION","SUBTRACTION","MULTPLICATION","DIV
    ISION"
32001 DATA10,10,10,10,5,45
32002 DATA10,10,10,10,9,81
32003 DATA100,10,99,100,9,999
32004 DATA100,100,200,100,99,999
32010 DATA"TRACKING - GO!!","  RANGE - GO!!"," SAFETY -
    GO!!"
32020 DATA" ROCKET - GO!!","ALL SYSTEMS GO!","FINAL COU
    NTDOWN"


DONE
```

Program Listing. Mission Control

First find how much space is left over after the program is loaded. Subtract 16 from that number; sixteen bytes are needed for an array. This is the amount of room available. Next calculate the amount of memory needed for the changes (Table 1).

Modification number one: As the program now stands, if the user misses a problem the next one will be a different operation. To give him the same operation as the one missed, type in the following line:

```
2895IFK<98F=F-1
```

Modification number two: If you desire to change the skill levels, enter Fig. 1 into your computer. Substitute the desired numbers for the lowercase letters. For example, suppose that for skill level one you want the highest value assigned to the first addend to be 10, the highest value assigned to the second addend to be 5, the highest sum allowed to be 13; the assigned multiplicand value to be no greater then 3, the assigned multiplier value to be no greater than 6, and the result to be a maximum of 12. You would type:

```
32001D.10,5,12,3,6,12
```

(Note that the line number for this modification is 32001, *not* 3200. Similarly the line number for skill level two would 32002,

```
40P=w:A=x:T=y:S=z
```

w = Number of problems must answer correctly for skill level one
x = Extra number of problems per skill level increase (E.G.: Skill level three would require w + x*3 problems done correctly)
y = Number of extra tries
z = Number of skill levels available

Fig. 2. Modifications Three-Five

```
35ENTER
36ENTER
37ENTER
41A(0)=w:A(1)=x:A(2)=y:A(3)=z
50ENTER
55ENTER
32000ENTER
```

w = Addition
x = Subtraction
y = Multiplication
z = Division

For w, x, y, z: If equals one, you want that type of problem; zero if you don't

Fig. 3. Modification of Operation Choice

Variable	Lines Used	Use
A$	41-50	Math operation name
	600-640	Math symbol (+, −, ×)
	2500	Annunciator message
	5000-5120	Annunciator message
	90(for mod.#7)	Dummy
B$	30-5120	Holds fifteen spaces (used to clear display)
A(0-3)	41-5000	Holds user's operation choices (1 = yes, 0 = no) 0: addition 1: subtraction 2:multiplication 3: division
A	32	Random seed
	39-97	Increase, for each level above level one, in number of problems the student must answer correctly
	210-400	First addition/subtraction number
	500-2300	Goes into this block as add/sub number, comes out as top number of problem I.E.: A + B = C; A − B = C; A × B = C; B)A C
B	32,98	Dummy
	210-400	Second number for add/sub
	500-630	Goes in as second number for add/sub, comes out as bottom number of problem
C	500-2300	Answer to problem
D	230,500,620, 630,2300	Input to DIG# subroutine
E	50-55,90-97, 900-1100,1410, 6040-6050	Input
F	39-5000	Which operation currently doing (1:add 2:sub 3:mult 4:div)
G	220-400,500,620	First mult/div number
H	220-400,500,620	Second mult/div number
I	200-6015	Total number of problems attempted
J	41-55,100-165, 5200,5299	For-next loops, usually graphics
	200-5000	Number of problems student has yet to answer correctly
K	37,100-165,510 640,500-5299	For-next loops. Graphics
	1100-1700 (2300-2395 for mod. #1,	For-next loop; Extra attempt counter; Flag (K<98 if user didn't get problem right, K = 0 if got right on first attempt)
L	41-55,230,620 1200,2000,2300, 2390,2500,5000, 6030 (630 for mod. #6)	General purpose; temporary
	5200-5299	For-next. Graphics
M	97-6010	Initial value for number of problems student must answer correctly
N	41-55,	Used for indirect input (if user wants "N", "NO", etc.)
	6030-6045	
	230,500,510, 620,630-640,2300	Output of DIG# subroutine
O	98,230,610,620	Temporary
	5200-5299	Used in graphics (holds last height)
P	39-98	Number of problems must answer correctly for skill level one
Q	39-5000	Holds number of last annunciator message displayed
R	39-6015	Number of problems student answered correctly on first attempt
S	39-98	Number of skill levels available
T	39-5000	Number of extra attempts user gets
U-Z	97-5000	Difficulties of problems for chosen skill
Y	41-55,6030-6045	Used in indirect inputing (like N)

Table 2. List of Variables

Routine	Lines	Var.	Uses
DELAY	2	L	Temporary
DIO#	4-5	D,N,	D = Input, N = Output
SWITCH	6-7	B,C,O	B&C = Input&Output, O = temporary
ROCKET	3000-30070	J,K	For-next loops (graphics)

Table 2a. Subroutines

etc.)

Modifications three, four, and five: To change the number of extra tries given the student, and/or the number of problems that have to be answered correctly before the rocket will launch, and/or the number of skill levels, input the line shown in Fig. 2, using what part of it you need. If, for example, you wanted five extre attempts and six skill levels, but want to leave the number of problems as is, you would type:

```
40T = 5:S = 6
```

If you ere going to change the number of skill levels to less than four, you should delete some of the lines which define the difficultias. Let's say that you only want two skill lavels. You then heve to delete the lines for skill levels three and four. To do this, type:

```
32003 ENTER
32004 ENTER
```

If you want more than four skill levels, you will have to add lines in the manner of modification two. If you desire five skill levels with the maximum values being 10, 10, 20 (addition) and 5, 5, 25 (multiplicetion) you would type:

```
32005O,10,10,20,5,5,25
```

You may have e maximum of nine skill lavels.

Modification number six: To take away the user's freedom to choose operations (+, −, ×, ÷), use the lines in Fig. 3.

Be very sure not to tell the computer to do nothing, e.g.:

```
41A(0) = 0:A(1) = 0:A(3) = 0
```

If you do, the computer will get stuck!

Modification number seven: To freeze the skill level at some particuler difficulty, enter the following:

```
90.:I."PRESS 'ENTER'
KEY TO GO ON";A$
93E = z
z = Skill level wanted
```

You must be careful to specify e skill level that is available.

If you don't expect to change the skill level often you can save space by cutting the skill levels down to one (modification five). Make level one es difficult es you want (modification two), end then freeze the skill level at level one.

Modification number eight: Type in the lines which are in Fig. 4 and the computer will give practice in negetive numbers.

Modification number nine: As it comes from the factory, Mission Control will give you the enswer to a problem you can't answer correctly, wait three seconds, and then continue. If you would rather have it wait until you're ready, use the following lines:

```
2393IFK<98P.A.410,"PRESS 'ENTER'
KEY TO GO ON";:I.A$:P.A.410
```

The computer will wait for you to push the ENTER key before going on.

Converting to Other BASICs

Those of you who don't have a

```
233IFR.(0)>.5A = −A
237IFR.(0)>.5B = −B
243IFR.(0)>.5G = −G
247IFR.(0)>.5H = −N
630O = B:GOS.4:L = N:P.A.97 − N,
 B;:O = A:GOS.4:P.A.33 − N,A;:IFN
 <LN = L
 4F.N = 1TO9:O = A.(D/10):
 IFD> = 1N.N
```

Fig. 4. Negative Number Modification

C.	CLS
D.	DATA
E.	END
F.	FOR
N.	NEXT
S.	STEP
G.	GOTO
GOS.	GOSUB
I.	INPUT
N.	NEXT
P.	PRINT
P.A.	PRINT AT
RET.	RETURN
S.	STEP (FOR-NEXT)
T.	THEN
A.(X)	ABS(X)
I.(X)	INT(X)
P.(X,Y)	POINT(X,Y)
R.(X)	RND(X)
R.(X,Y)	RESET(X,Y)
S.(X,Y)	SET(X,Y)
T.(X)	TAB(X)

Table 3. Level I BASIC Abbreviations

SOFTWARE → TRS-80 ← SOFTWARE

PACKAGE ONE INCLUDES: GRAPHIC-TREK "2000" — This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprise to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players! ★ **INVASION WORG** — Time: 3099, Place: Earth's Solar System Mission: As general of Earth's forces, your job is to stop the Worg invasion and destroy their outposts on Mars, Venus, Saturn, Neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Neutrino Blasters! Worg Forces: Robots — Saucers — Disintegrators — Proton Destroyers! Multi level game lets you advance to a more complicated game as you get better! ★ **STAR WARS** Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb, then escape via the only exit. This graphics game is really fun! May the Force be with you! ★ **SPACE TARGET** — Shoot at enemy Ships with your missiles. If they eject in a parachute, capture them — or if you're cruel, destroy them! Full graphics, real time game! ★ **SAUCERS** This fast action graphics game has a time limit! Can you be the commander to win the distinguished cross? Requires split second timing to win! Watch out!

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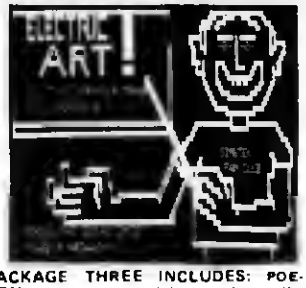
PACKAGE TWO INCLUDES: CHECKERS 2.1 — Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. ★ **POKER FACE** — The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match! (Plays 5 card draw). ★ **PSYCHIC** — Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for parties. ★ **TANGLE MANIA** — Try and force your opponent into an immobile position. But watch out, they're doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!) ★ **WORD SCRAMBLE** — This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles the word, then keeps track of wrong guesses.

ONLY 14.95



PACKAGE THREE INCLUDES: POETRY — This program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then the mood, and it does the rest! It has a 1000-word + vocabulary of nouns, verbs, adjectives and adverbs! ★ **ELECTRIC ARTIST** — Manual: draw, erase, move as well as; Auto: draw, erase and move. Uses graphics bits not bytes. Saves drawing on tape or disk! ★ **GALACTIC BATTLE** — The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time! ★ **WORD MANIA** — Can you guess the computer's words using your human intuitive and logical abilities? You'll need to, to beat the computer! ★ **AIR COMMAND** — Battle the Kamikaze pilots. Requires split second timing. This is a FAST action arcade game.

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PACKAGE FOUR INCLUDES: LIFE — This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, the computer does the rest! Program can be stopped and changes made! Watch it grow! ★ **SPACE LANDER** — This full graphics simulator lets you pick what planet, asteroid or moon you wish to land on! Has 3 skill levels that make it fun for everyone. ★ **GREED II** — Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy! ★ **THE PHARAOH** — Rule the ancient city of Alexandria! Buy or sell land. Keep your people from revolting! Stop the rampaging rats. Requires a true political personality to become good! ★ **ROBOT HUNTER** — A group of renegade robots have escaped and are spotted in an old ghost town on Mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

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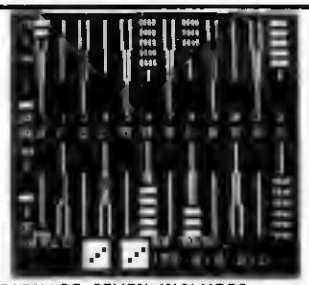

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Level I TRS-80 but want to use this program on your computer will need to know a few details about this BASIC.

Graphics: The 80 has a graphics resolution of 128 vertical by 48 horizontal. The top left corner is position (0,0) and the bottom right is position (127,47). The commands used to manipulate these points are:

SET(X,Y)	Turn on the graphics spot at (X,Y).
RESET(X,Y)	Turn off the spot at (X,Y).
POINT(X,Y)	A function which returns (is equal to) 1 if the spot is on, and 0 if it is off.
CLS	Clears the screen and puts the cursor at the top left corner.

Print formatting: Level I has a PRINT AT X statement which moves the cursor to position X on the screen before printing. The top left corner is position 0, and the bottom right is position 1023. A comma, seperating items in a PRINT statement (for example PRINT A,B,C) puts the item following the comma in the next print field.

Fields start at columns 0, 16, 32, and 48 in each line. Semicolons put the next item immediately after the previous item. An exception is "PRINT AT,", which is the same as "PRINT AT;".

FOR-NEXT loops: BASIC will always run through a FOR-NEXT loop at least once; it checks if the variable is in bounds at the NEXT point, not at FOR.

IF X THEN Y: If X is false, it will jump to the next line; it will not do the next statement in a multistatement line. Y may be any legal statement, not just a line number. THEN is optional.

Random numbers: RND(X) returns a random number between 0 and 1 if X<1. If X≥1, RND(X) is a random integer between 1 and X. An equivalent statement is INT(RND(0)*X) + 1.

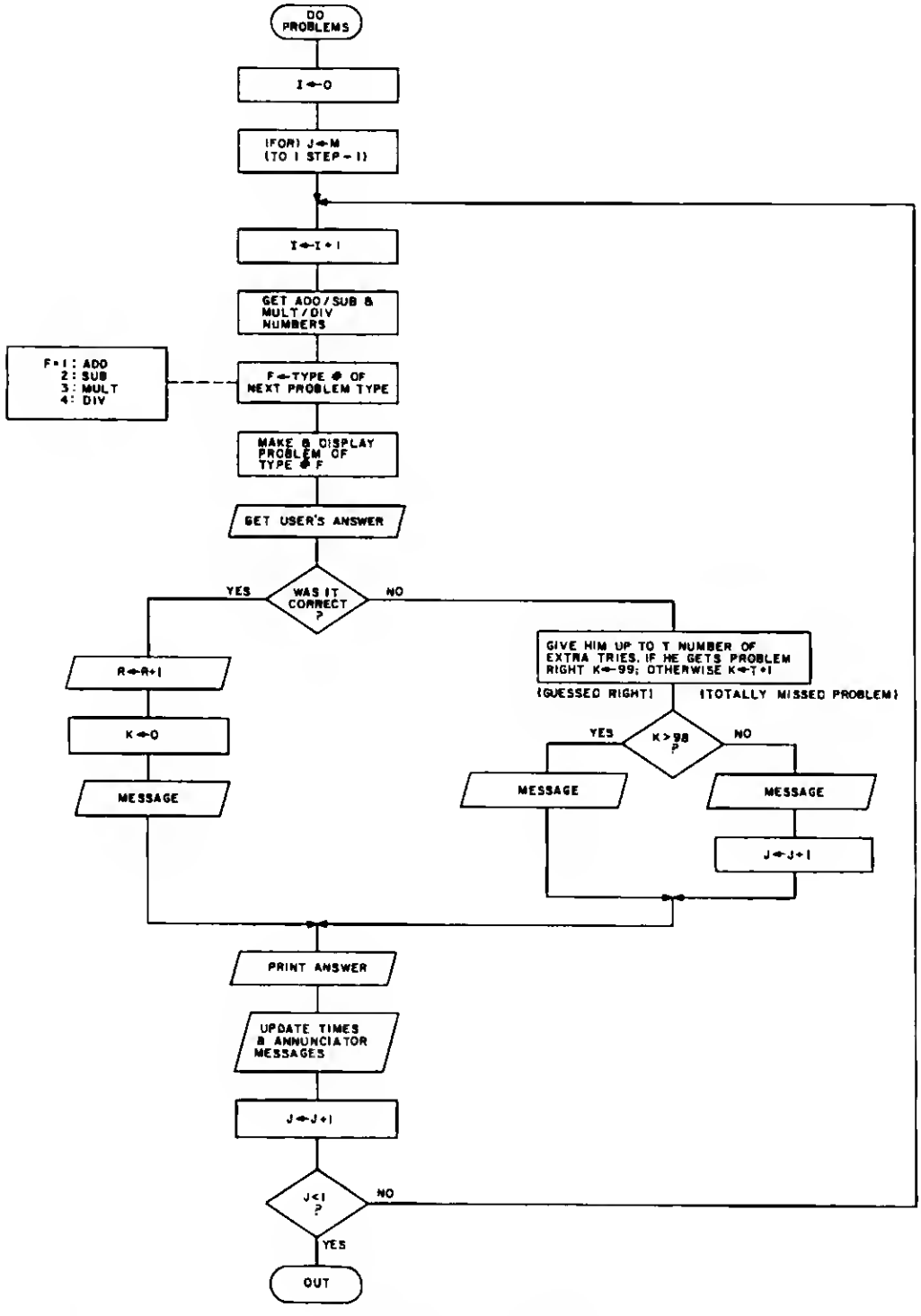
Logical operations: The symbol for AND is *, and + stands for OR.

Numerical input: This BASIC allows you to input a variable name where a number is wanted. Only the first letter is looked at. Thus, YES would input the value of Y.

Variables (Table 2): Only twenty-six numeric variables are allowed (A-Z). There are two string variables (A$ and B$), each containing up to fifteen characters. All variables are defined from the moment you turn the computer on until the moment you turn it off. (Of course, until you assign it a value, it could be any random number, a characteristic I use in initializing the random number generator.)

A single one-dimensional array is available—array A. It uses whatever memory is not needed by the program, therefore there is no DIM statement. Each element takes four bytes. In Mission Control four elements are used, for a total of sixteen bytes.

Abbreviations: Level I BASIC allows abbreviations of instructions. A list of these is shown in Table 3.



Flowchart 2. Main Loop Detail

End of Lecture

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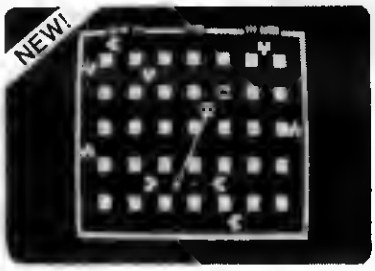

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Menu List Selection Subroutine

Frank B. Rowlett, Jr.
4272 Lancaster Drive
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You've probably eaten in restaurants where the major items on the menu have numbers next to them and you order by giving the numbers.

By doing this everything is simplified. Time is saved. Information is accurate. It is quickly given, transmitted and acted on.

Choosing Options

The same technique can be used in interactive application programming. Menu selection —or list selection—is an important tool. It allows the user to specify an option.

The usual procedure presents a list of options available and the user indicates which one he wants. This is done by numbering the options and having the user enter the number. Table 1 illustrates a typical list as might be displayed by a computer.

The list selection technique was originally developed for

```
INPUT:  X  = STARTING LOCTION TO PRINT INDICATOR
        X0 = NUMBER OF ITEMS IN MENU

OUTPUT: X  = NUMBER OF ITEM SELECTED

USES:   X, X0, X1, X2, X3 AND B


1000 X1 = X                                 'SET X1 TO 1ST ITEM PRINT LOCATION
1010 PRINT@960,CHR$(30);"[ MOVES INDICATOR UP, ";CHR$(92);" MOVES INDICATOR DOWN
, ";CHR$(34);"ENTER";CHR$(34);" TO SELECT";
                                            'PRINT INSTRUCTIONS
1020 PRINT@X1, CHR$(143);                   'PRINT GRAPHIC BLOCK
1030 FOR X2 = 0 TO 2                        'SET TIMING LOOP
1040 B = INKEY$                             'GET ANY INPUT
1050 IF B = "" THEN NEXT X2 ELSE 1100       'SEE IF THERE WAS ANY INPUT
1060 PRINT@X1, CHR$(94);                    'PRINT A RIGHT ARROW
1070 FOR X2 = 0 TO 9                        'SET TIMING LOOP
1080 B = INKEY$                             'GET ANY INPUT
1090 IF B = "" THEN NEXT X2: GOTO 1020      'SEE IF THERE WAS ANY INPUT
1100 PRINT@X1, " ";                         'CLEAR SCREEN LOCATION IF INPUT
1110 IF ASC(B) = 91 THEN 1170               'SEE IF INPUT WAS AN UP ARROW
1120 IF ASC(B) = 10 THEN 1200               'SEE IF INPUT WAS A DOWN ARROW
1130 IF ASC(B) <> 13 THEN 1020              'NOT LEGAL KEY, GOT GET INPUT
1140 PRINT@X1, CHR$(94);                    'ENTER PRESSED, GET SELECTED INDICATOR
1150 X = (X1 - X) / 64 + 1                  'SET X TO NUMBER OF SELECTED ITEM
1160 RETURN                                 'RETURN FOR MENU SELECTION
1170 X1 = X1 - 64                           'SET INDICATOR LOCATION UP ONE LINE
1180 IF X1 < X THEN X1 = X+(X0-1)*64        'IF ABOVE, SET TO BOTTOM
1190 GOTO 1220                              'SEE IF KEY KEPT PRESSED
1200 X1 = X1 + 64                           'SET INDICATOR LOCATION DOWN ONE LINE
1210 IF X1 = X + X0 * 64 THEN X1 = X        'IF BELOW, SET TO TOP
1220 X3 = 0                                 'SET TO BLINK INDICTOR TWICE
1230 PRINT@X1, CHR$(143);                   'PRINT A GRAPHIC BLOCK
1240 FOR X2 = 0 TO 5                        'SET TIMING LOOP
1250 NEXT X2
1260 PRINT@X1, CHR$(94);                    'PRINT A RIGHT ARROW
1270 FOR X2 = 0 TO 19                       'SET TIMING LOOP
1280 NEXT X2
1290 IF X3 = 0 THEN X3 = 1 : GOTO 1230      'SEE IF BLINKED TWICE
1300 X3 = PEEK ( 14656 )                    'SEE IF KEY STILL PRESSED
1310 PRINT@X1, " ";                         'BLANK PRINT LOCATION
1320 IF X3 = 8 THEN 1170                    'GO PROCESS IF UP ARROW PRESSED
1330 IF X3 = 16 THEN 1200                   'GO PROCESS IF DOWN ARROW PRESSED
1340 GOTO 1020                              'IF NO KEY PRESSED GO GET INPUT
```

Program Listing 1

hard copy terminals. The list was printed and the user asked to enter the number.

A method more advenced than specifying the number of the option desired is illustreted in the List Selection subroutine.

List Selection

This subroutine requires that the list of options be displayed on the screen. A blinking indicator is placed by the first option. It can be moved from option to option by using the down arrow and up arrow keys.

If the indicator is at the first option in the list and the up arrow key is pressed, it goes to the last option. If it is at the last and the down arrow is pressed, it goes to the first. Continuous key depression moves the cursor up or down the list.

Once the user has it positioned at the option he wants, he presses ENTER. This indicates which option is selected. At the same time, the position of the option in the list is stored in an integer variable (1, 2, 3 and so on). The subroutine then returns control to the calling program.

Program Listing 1 illustrates one version of the subroutine. This listing is basically one statement per line. The remarks show you how the subroutine works. Program Listing 2 shows a condensed version of the subroutine. It is more efficient and uses a minimum of memory, but is more complicated to enter into the computer. Both versions require exactly the same preparation and input, and they give exactly the same output.

Note the [left bracket in line number 1010 of Program Listing 1 and line number 1000 of Program Listing 2. It is really an up arrow.

The subroutines require the

```
SELECT DESIRED OPTION:

  1 LIST DATA ENTRIES
  2 PRINT DATA ENTRIES
  3 SORT DATA ENTRIES
  4 QUIT

ENTER NUMBER OF DESIRED
OPTION: ?
```

Table 1

```
INPUT:  X  = STARTING LOCTION TO PRINT INDICATOR
        X0 = NUMBER OF ITEMS IN MENU

OUTPUT: X  = NUMBER OF ITEN SELECTED

USES:   X, X0, X1, X2, X3 AND B


1000 X1=X:PRINT@960,CHR$(30);"[ MOVES INDICATOR UP, "CHR$(92);"
 MOVES INDICATOR DOWN, ";CHR$(34);"ENTER";CHR$(34);" TO SELECT";
1010 PRINT@X1,CHR$(143);:FORX2=0TO2:B=INKEY$:IFB=""THENNEXTX2:PR
INT@X1,CHR$(94);:FORX2=0TO9:B=INKEY$:IFB=""THENNEXTX2:GOTO1010
1020 PRINT@X1," ";:X2=ASC(B):IFX2=91THEN1030ELSEIFX2=10THEN1040E
LSEIFX2=13THENPRINT@X1,CHR$(94);:X=(X1-X)/64+1:RETURNELSE1010
1030 X3=0:X1=X1-64:IFX1<XTHENX1=X+(X0-1)*64:GOTO1050ELSE1050
1040 X3=0:X1=X1+64:IFX1=X+X0*64THENX1=X
1050 PRINT@X1,CHR$(143);:FORX2=0TO5:NEXTX2:PRINT@X1,CHR$(94);:FO
RX2=0TO19:NEXTX2:IFX3<2THENX3=X3+1:GOTO1050ELSEX3=PEEK(14656):PR
INT@X1," ";:IFX3=0THEN1030ELSEIFX3=16THEN1040ELSE1010
```

Program Listing 2

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calling program to print the list of options on the display screen. Each must be a single line. The second option must be on the line immediately following the first, the third option on the line immediately following the second and so on. There can be no blank or text lines mixed with the option list.

Integer X

The subroutines require the integer variable X as input. X contains the location on the screen of where to print the indicator for the first option. All future movements of the indicator will be in multiples of 64 screen positions.

The indicator consists of two characters printed rapidly, one after another. The first is a white square that consists of the upper four graphic cells of a graphics character (ASCII code 143–a character size square). It is printed momentarily and is overprinted by a right arrow. This is repeated at the approximate rate of three per second to produce the blinking indicator. It appears as pronounced right arrow superimposed over a white square.

The subroutines require that the integer variable X0 be input. It contains the number of options in the list and is used to determine where the end is.

The subroutines cannot handle more than 15 options to a list, because there are only 16

```
20 DEFINT X                              'VARIABLES BEGINNING WITH X AS INTEGERS
30 DEFSTR B                              'VARIABLES BEGINNING WITH B AS STRINGS
99 'DEMO PROGRAM'

100 CLS                                  'CLEAR SCREEN
110 PRINT@22, "MENU DEMO PROGRAM"        'PRINT HEADING
120 A$ = CHR$(26)+CHR$(29)+CHR$(217)     'SKIP TO 25TH POSITION OF NEXT LINE
130 FOR X = 1 TO 5                       'DO LOOP FIVE TIMES
140 PRINTA$; "ITEM NUMBER"; X;           'PRINT ITEM PLUS ITEM NUMBER
150 NEXT X                               'REPEAT TILL FIVE PRINTED
160 X = 151                              'SET X TO TWO POSITIONS BEFORE FIRST ITEM
170 X0 = 5                               'SET X0 TO NUMBER OF ITEMS
180 GOSUB 1000                           'GO GET AN ITEM FROM THE MENU
190 PRINT@662,"YOU SELECTED ITEM ";      'SET TO PRINT ITEM NUMBER SELECTED
200 ON X GOTO 210, 230, 250, 270, 290    'GOTO CODE TO PROCESS SELECTION
210 PRINT "1"                            'CODE FOR FIRST ITEM
220 GOTO 300                             'GOTO TRY AGAIN CODE
230 PRINT "2"                            'CODE FOR SECOND ITEM
240 GOTO 300                             'GOTO TRY AGAIN CODE
250 PRINT "3"                            'CODE FOR THIRD ITEM
260 GOTO 300                             'GOTO TRY AGAIN CODE
270 PRINT "4"                            'CODE FOR FOURTH ITEM
280 GOTO 300                             'GOTO TRY AGAIN CODE
290 PRINT "5"                            'CODE FOR FIFTH ITEM
300 PRINT@960,CHR$(30);STRING$(18," ");"PRESS ";CHR$(34);"ENTER";CHR$(34);" TO T
RY AGAIN";
310 B = INKEY$                           'LOOK FOR INPUT
320 IF B = "" THEN 310                   'IF NOTHING, TRY AGAIN
330 PRINT@640, CHR$(30);                 'CLEAR ITEM MESSAGE
340 GOTO 100                             'GO DO DEMO AGAIN
```

Program Listing 3

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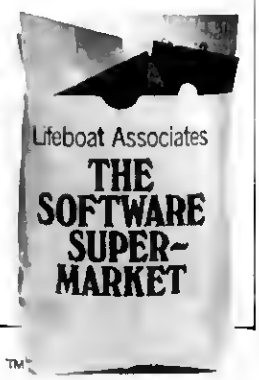

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lines on the display screen, and the subroutine prints instructions on the last.

When the subroutine returns control to the calling program, the number option selected is stored in the integer variable X. Also, the indicator at the option selected is replaced by a right arrow on the screen.

In addition to the integer variables X and X0, the subroutines use the integer variables X1, X2 and X3, and the string variable B. Any information stored in these variables when the List Selection subroutine is called will be lost. The calling program should use them as temporary variables before and after calling the subroutine.

Variables beginning with X should be defined as integers at the start of the program by using a DEFINT statement. Variables beginning with a B should be defined as strings using a DEFSTR statement. If you don't define it, the appropriate variable must be indicated with its name, including a declaration character.

Testing, Testing

Program Listing 3 is a demonstration to test the subroutines. Note the variable A$ in line 120 of the demonstration. It contains three characters: a move cursor down character, a position cursor at the front of the line character, and a tab 25 character. By printing this string, the cursor is set to the 25th position on the next line. A short list can then be printed with a single PRINT statement. For example, the statement:

```
PRINT @64, A$; "SORT"; A$;
"MERGE"; A$; "QUIT"
```

would print, starting at the 25th position of the line, on the third, fourth and fifth lines of the display screen:

```
SORT
MERGE
QUIT
```

You can experiment with making up your own control strings.

"The subroutines cannot handle more than 15 options to a list because there are only 16 lines on the display screen. . . (with) instructions on the last."

There is another technique shown in line 300 of the demonstration program. A CHR$(30); is printed as the first character of the message. This causes the line to be blanked before the text is printed. If the new text is shorter than the information already on the line, no residual text from the original contents will be left.

Line 200 of the program is an ON X GOTO statement. This is also an efficient way of executing the desired code for the option selected. It uses the integer variable X to provide the option selected.

Two Benefits

Besides having debugged code available, there are two benefits for the application programmer when using these subroutines. First, only a legal option can be selected—there is no need to use time and memory to test the input. Second, the user cannot destroy the display by entering too long a value (causing a line feed) or entering an illegal character.

Making a selection this way is easy. Because there is a direct visual link to what is being selected—both the blinking indicator and the option description text are on the same display line—there is less opportunity to make the wrong choice. ■

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by Carl A. Kollar

[Reprint of June 1980 Review, *80 Microcomputing*]

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of 8½ × 11 papers stapled together. It is written in the nicest format I've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE"filename": Saves your BASIC program on cassette.
LOAD: Reads the next BASIC program from the cassette.
LOAD"filename": Searches for and loads the specified file from cassette.
LOAD? and LOAD?"filename": Reads file from cassette, and compares contents to memory.
LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.
LOADN"filename": Same as above except the tape will stop at the end of the program named.
KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.
RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.
RUN"filename": TC-8 searches for a specified program and runs it immediately.
PUT"filename": Same as SAVE "filename", except it is for use with system tapes.
GET: Same as LOAD, except it is for use with system tapes.
GET"filename": Same as LOAD "filename", except it is for use with system tapes.
GET? and GET?"filename": Same as LOAD? and LOAD?"filename", except it is for use with system tapes.
GETN and GETN"filename": Same as LOADN and LOADN"filename", except it is for use with system tapes.
OPEN: Required before cassette input or output of a data file can be attempted.
CLOSE: Required to end a cassette data file.
PRINT#: Allows numerical or string data to be output to a cassette file.
INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button. ■

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Programs that can alter their own codes have always conjured up images of computers that may learn to rule the world, only to be foiled in the end by their human creators.

Unfortunately, when self-modifying code is attempted on a microcomputer, especially in BASIC, the end result is usually the machine being turned off, then back on, to undo the damage that was done.

One-Byte Codes

Writing a BASIC program that can modify itself means POKEing BASIC statements into the area of RAM that stores the programs.

The Level II manual states that reserved words like GOTO and PRINT are stored as one-byte codes, but for some reason it never gets around to mentioning what those codes are. Since they are stored in ROM, this information cannot stay hidden forever. Program Listing 1 brings them out.

Each function has its own code. When the BASIC interpreter comes across one of these codes, it translates it into the proper word. By POKEing the proper codes into memory, statements can be changed and added to the program, by the program itself.

Now, a suitable place must be found for the statement. One solution is to have the program search to find a key word in the program text and to replace that word with the desired one. Program Listing 2 demonstrates this. Type the program, LIST it, RUN it, then LIST it again. If all went well, the last line should read 60 PRINT.

Line 10 of the program sets up a loop that steps through the program text. It begins at location 17129, since that is the address in memory where BASIC storage begins. The next line looks into the memory location and checks for 230, which is the code for CVI (a false command). If it finds it, 178 (the code for PRINT) is POKEd into that address.

The reason I chose the command CVI is because it is a disk command and thus totally undigestable by the Level II interpreter; more importantly, it is a command that would never appear in a Level II BASIC listing.

One Application

One possible application for a self-modifying code is in the evaluation of an equation that has been entered and stored as a string variable. (Those of you who have tried, know how difficult a task that is).

For example, you have just written a program that can graph any function, but unfortunately it requires, as most do, that the function be a program line. This poses no problem for you, since it is easy enough to change one line in the program. However, if you wanted your class or kid brother to use it they

```
10 K=128
20 FOR S=5712 TO 6188
30 IF PEEK(S)>128 THEN PRINT:PRINT K;"  ";CHR$(PEEK(S)-
   128);:K=K+1:GOTO 50
40 PRINT CHR$(PEEK(S));
50 NEXT S
```

Program Listing 1.

```
10 FOR LO=17129 TO 28888
20 IF PEEK(LO)=230 THEN 40
30 NEXT LO
40 POKE LO,178
50 END
60 CVI
```

Program Listing 2.

would also have to change the program. Ideally, the program should input the function as a string, then evaluate it.

Program Listing 3 prints Y = on the screen, then inputs the other half of the equation and stores it as a string variable. It turns the equation into a program statement, executes it, and prints the value for Y. It could just as easily call a subroutine that will graph the equation.

It is very important when typing the program that line 130 contain CVI twice and is followed by several blanks. (The *s in the listing indicate those blanks.) If they are not there, the next line or several lines will be destroyed. This type of programming is a bit more dangerous than usual.

As before, the program steps through the memory looking for CVI. This time however, it checks for two in a row since line number 230 could be mistaken for the code for CVI. Line 70 puts the Y = in place of the two CVIs. Lines 80-100 put the equation, stored in E$, into the program character by character.

The next line places :REM at the end of the equation, so anything on the rest of the line will be ignored. Since the operators (+, −, *, /, ↑) have their own codes as well, lines 120-150 scan through the newly implented line to find them. Control is then transferred to lines 170-220, which act as a mini-interpreter, converting the ASCII values of the operators to the proper codes using the data at the end of the program.

The program then executes the created line and prints the value for Y. Line 260 puts the CVIs back so the program can be broken and then RUN again.

If you're skeptical as to whether or not the program is changing, then type 255 LIST. Make sure when you remove this line that the two CVIs are back in line 230.

The program is able to handle any equation, including those with variables. It is not able to

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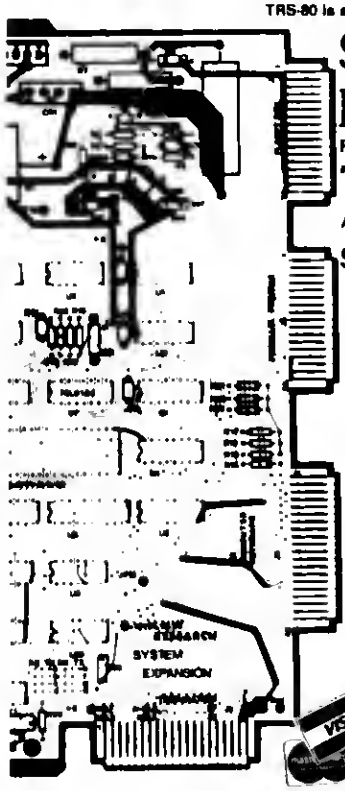

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teckle equations with functions such as sine or cosine, since those must be stored according to their proper codes.

This technique requires some furious POKEing and PEEKing but it allows a wide range of inputs.

A note of caution about allowing the TRS-80 to program itself: If your '80 appears to be growing more powerful each day, make sure there is a clear path to the power cord.■

```
10 CLS:DEFINT L,Z:CLEAR 200
20 FOR LO=17129 TO 32000
30 IF PEEK(LO)=230 AND PEEK(LO+1)=230 THEN 60
40 NEXT LO
50 PRINT"CVI NEVER FOUND":STOP
60 PRINT"Y=":INPUT E$
70 POKE LO,89:POKE LO+1,213
80 FOR Z=1 TO LEN(E$)
90 POKE (LO+2+Z-1),ASC(MID$(E$,Z,1))
100 NEXT Z
110 POKE LO+3+LEN(E$),147:POKE LO+2+LEN(E$),58
120 FOR Z=0 TO LEN(E$)+2
130 IF PEEK(LO+Z) > 41 AND PEEK(LO+Z) < 48 THEN 170
140 IF PEEK(LO+Z)=91 THEN POKE LO+Z,209
150 NEXT Z
160 GOTO 230
170 IF PEEK(LO+Z)=46 THEN 150
180 FOR ZS= 1 TO PEEK(LO+Z)-41
190 READ VA:NEXT ZS
200 POKE LO+Z,VA
210 RESTORE
220 GOTO 150
230 CV1CVI                                          ******
    *
240 PRINT Y
250 PRINT:PRINT
260 POKE LO,23B:POKE LO+1,23B
270 GOTO60
280 DATA 207,205,251,206,251,200
```

Program Listing 3.

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If your object code crucifies your BASIC program. . .

Resurrect It!

Thomas L. Quindry
TLQ Enterprises
6237 Windward Drive
Burke, VA 22015

Have you ever lost your BASIC program through an error in BASIC or object code programming? Sometimes an error can crash your program, and, unless painstaking resurrection efforts are undertaken, all is lost.

Actually only a few bytes of the program are lost. The rest of the program still resides in memory, but without the properly set key memory locations, it is hard to make it mean anything.

Initialized Memory

When your computer is first turned on, or you enter SYSTEM (10), a series of pointers are set and some values are placed in the usable program memory area at locations 42E9, 42EA, and 4330 through 4348 (17129, 17130, and 17200 through 17227 in decimal).

Most BASIC programs, however, include code in these locations, and if initialization occurs when a BASIC program is resident, these 30 bytes of memory are destroyed including the Start of BASIC Pointer, 40A4 and 40A5, and the End of BASIC Pointer, 40F9 and 40FA. The two bytes at 42E9 and 42EA, which can also be lost when the command NEW is entered, comprise a pointer to the second line of your BASIC program.

On initialization bytes 40A4 and 40A5 point to the 42E9 which is the normal Start of BASIC Program. Sometimes, while doing other computer tricks, a programmer intentionally POKEs different values into 40A4 and 40A5 so that the BASIC program starts at a different memory location. Locations 42E9 and 42EA in these cases contain zeros at start up which tell the computer that no program is in memory, and the pointer at 40F9 and 40FA is set to value 42EB, two bytes after 42E9.

To resurrect your "lost" program, then, you must correct the values at these 34 byte locations: the two two-byte pointers and the 30 bytes in the BASIC program memory area. Additionally, if you have changed the Start of BASIC Pointer, you must also replace the two bytes starting at the new address. Of course, in order to replace them you must know what these bytes are. One option is to save their values at another place in memory. These values have to be continually updated for every change in BASIC, and it can be quite tedious, if done manually. The locations that need to be stored are given in Table 1.

Never fear, there are ways to save the byte values at these locations automatically. My machine language program (Program Listing 1) performs this operation as long as certain conditions are met. The key to this program is a "patch" through the keyboard driver routine labeled PATCH in Listing 1.

Whenever the computer looks for an input from the keyboard, it passes through a routine which looks to locations 4016 and 4017 for an address to continue to. On initialization, the address at this location is 03E3, the keyboard driver routine. We can interrupt the computer at this point and enter our own address at 4016 and 4017 to branch to our time-sharing routine and save the needed information before returning to 03E3. Then, every time the computer looks for a keystroke, until there is a program crash, the values of our 36 crucial bytes are continually refreshed into the memory saving locations.

Operation

First the routine checks for a BASIC program. It does this by checking to see where the End of BASIC Pointer is with respect to the Start of BASIC Pointer. If

HEX		DECIMAL	
40A4		16548	Start of BASIC
40A5		16549	Pointer
40F9		16633	End of BASIC
40FA		16634	Pointer
42E9		17129	Destroyed memory (Normally coincides with
42EA		17130	nnnn—see text.)
nnnn			Next Line Pointer
nnnn			at start of BASIC
4330		17200	Destroyed memory
	thru		
4348		17227	

Table 1. Bytes to be Restored after a System Crash.

no program is present, the End of BASIC Pointer address will be two bytes greater than the Start of BASIC Pointer. When this condition exists, the 36 byte values in higher memory are not changed.

Enter the RESTOR program with SYSTEM(/). The protected memory of your computer must be set to at least 32625 before the program is enabled and reset after every system crash.

When a system crash occurs, set MEMORY SIZE, enter SYSTEM and then (/32625). The RESTOR subroutine (same name as program) then performs a block move of your "lost" bytes back to their proper locations and your BASIC program has been saved. The RESTOR program is then re-enabled.

The same procedure is used to restore your program when the NEW command has been inadvertently entered except that MEMORY SIZE is already set. If, after entering the NEW command, you wish to write a new program and not save the old one, simply enter the new program and its values will now be continually refreshed into the memory saving locations. This occurs because of our CHECK subroutine and because NEW does not disable the RESTOR program.

This routine works as long as your system crash does not lock up the computer, destroy other BASIC memory or the RESTOR memory locations. Even if some of the RESTOR memory locations are destroyed, you may be able to enter the RESTOR program again. This time, instead of entering (/), enter (/32625). The RESTOR subroutine automatically enables the program after returning the lost data.

I do have one word of caution. Since this program works through a patch to the keyboard routine, if you enter any program that overwrites any portion of RESTOR, you must first enter SYSTEM then (/0) to initialize the computer. This removes the patch from the keyboard driver. Of course, your BASIC program will then be lost. If this is not done, the keyboard driver routine will be directed to ambiguous memory locations and have no way to return to keyboard control. This locks up the computer.

If you really feel it is necessary to save your BASIC program from this untimely demise, you can either CSAVE it first or keep it by first POKEing 0s in the patch subroutine, initializing, and then entering SYSTEM (/32625). Don't try POKEing the address at 4016 and 4017, as this will lock up the computer in the process.

A cassette tape of this program is available from the author.■

```
                    00001 ;*****************************************
                    00002 ;*      RESTORES BASIC PROGRAM AFTER      *
                    00003 ;*      SYSTEM CRASH OR 'NEW' COMMAND     *
                    00004 ;*                                        *
                    00005 ;*      SAVE MEMORY SIZE OF 32625         *
                    00006 ;*      (/32625) TO RESTORE BASIC         *
                    00007 ;*****************************************
7F71                00008         ORG     32625
7F71 21DB7F         00009 RESTOR  LD      HL,BUFFER+1       ;RESTORE PROGRAM ROUTINE
7F74 ED5BF97F       00010         LD      DE,(BUFFER+31)
7F78 ED53A440       00011         LD      (40A4H),DE        ;RESTORE POINTER
7F7C 010200         00012         LD      BC,2
7F7F EDB0           00013         LDIR                      ;PERFORM BLOCK MOVE
7F81 21DD7F         00014         LD      HL,BUFFER+3
7F84 113843         00015         LD      DE,17208
7F87 011C00         00016         LD      BC,28
7F8A EDB0           00017         LDIR                      ;PERFORM BLOCK MOVE
7F8C 2AFB7F         00018         LD      HL,(BUFFER+33)
7F8F 22F940         00019         LD      (40F9H),HL        ;RESTORE POINTER
7F92 2AFD7F         00020         LD      HL,(BUFFER+35)
7F95 22E942         00021         LD      (42E9H),HL
7F98 21A17F         00022 PATCH   LD      HL,CHECK          ;INITIALIZE KEYBD PATCH
7F9B 221640         00023         LD      (4016H),HL
7F9E C3CC96         00024         JP      96CCH             ;RETURN TO BASIC
7FA1 3AF940         00025 CHECK   LD      A,(40F9H)         ;ADDRESS POINTER, NEXT BASIC LINE NUMBER
7FA4 2AA440         00026         LD      HL,(40A4H)        ;ADDRESS POINTER, START OF BASIC PROGRAM
7FA7 23             00027         INC     HL
7FA8 23             00028         INC     HL
7FA9 BD             00029         CP      L                 ;CHECK FOR START UP ADDR.
7FAA 2806           00030         JR      NZ,BLKMOV
7FAC 3AFA40         00031         LD      A,(40FAH)
7FAF BC             00032         CP      H
7FB0 2825           00033         JR      Z,BACK            ;IF START UP ADDR. RETURN
7FB2 010200         00034 BLKMOV  LD      BC,2              ;BLOCK MOVE FIRST 2 BYTES
7FB5 2AA440         00035         LD      HL,(40A4H)        ;ADDRESS POINTER, START OF BASIC PROGRAM
7FB8 22F07F         00036         LD      (BUFFER+31),HL          ;STORE POINTER
7FBB 11DB7F         00037         LD      DE,BUFFER+1
7FBE EDB0           00038         LDIR                      ;PERFORM BLOCK MOVE
7FC0 213843         00039         LD      HL,17208          ;START OF DESTROYED MEMORY
7FC3 11DD7F         00040         LD      DE,BUFFER+3
7FC6 011C00         00041         LD      BC,28
7FC9 EDB0           00042         LDIR                      ;PERFORM BLOCK MOVE
7FCB 2AF940         00043         LD      HL,(40F9H)
7FCE 22FB7F         00044         LD      (BUFFER+33),HL    ;STORE BASIC PROGRAM POINTER
7FD1 2AE942         00045         LD      HL,(42E9H)        ;NORMAL START OF BASIC
7FD4 22FD7F         00046         LD      (BUFFER+35),HL
7FD7 C3E303         00047 BACK    JP      03E3H             ;RETURN TO KEYBOARD DRIVER SUBROUTINE
7FDA 00             00048 BUFFER  NOP             ;SET UP POINTER FOR BUFFER AREA
7F98                00049         END     PATCH   ;INITIALIZE KEYBOARD PATCH
00000 TOTAL ERRORS
```

Program Listing 1. RESTOR Program.

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DOS Machine Code Loading Technique

Tim Turner
W. 2225 Houston
Spokane, WA 99208

Most TRS-80 users need a printer but their high price presents an obstacle to some. The introduction of the Heathkit H14 brings high quality, reliable print within the range of many potential users.

Since the H14 uses an RS-232 port, and standard TRSDOS uses the parallel port, a replacement driver routine must be written.

Radio Shack supplies a sample driver in the RS-232 documentation which works with the H14 at low speeds, but fails miserably at high baud rates. Despite what the manual says the handshaking latch is not tested for "printer busy." This may be cured by adding the three instructions shown in Listing 1.

```
00510         JR   Z,STATIN    ;LOOP IF NOT
00513  BUSY   IN   A,(RESURT)  ;READ MODEM STATUS
00514         BIT  6,A         ;TEST DSR FOR HI
00515         JR   Z, BUSY     ;LOOP IF BUSY
00520         LD   A,C         ;LOAD A W/CHAR
```

Program Listing 1. Fix Printer Busy Test

New Loading Technique

The inconvenience of loading such a routine and the occasional need to load other drivers and routines in high storage, led me to develop the following routine and general purpose loading technique.

The prologue code investigates the TRSDOS high storage address to avoid the last 64 bytes of memory. The high address is then backed up enough to hold the resident code (lines 190-340). This protects the code from BASIC.

The starting address and relocation factor are determined

```
0000'                          00010         ASEG
00E8                           00020   RESU  EQU  0E0H  ; OUT=RESET UART
                               00030                    ; IN=READ CTL BTS
00E9                           00040   SWIT  EQU  0E9H  ; OUT=LOAD BRG
                               00050                    ; IN=READ SWTCHS
00EA                           00060   CNTR  EQU  0EAH  ; OUT=LD UART CTL
                               00070                    ; IN=READ UART ST
00EB                           00080   DTAR  EQU  0EBH  ; OUT=LD HOLD REG
                               00090                    ; IN=READ DATA
4049                           00100   STRG  EQU  4049H ; END STRGE
402D                           00110   TRSD  EQU  402DH ; TRSDOS ENTRY
4025                           00120   DVCB  EQU  4025H ; PRT CTL BLK
                               00130         ORG  7000H ; PAST TRSDOS
                               00140   ; THIS PART OF CODE PERFORMS
                               00150   ; INITIALIZATION, IS NOT RESIDENT.
7000  31 70AB                  00160   BGN: LD    SP,STK ; STACK
                               00170   ; MUST FIRST ADJUST TRSDOS
                               00180   ; END OF STORAGE POINTER
7003  2A 4049                  00190         LD   HL,(STRG) ; END OF STRG
7006  7D                      00200         LD   A,L    ; LOW PART
7007  FE FF                   00210         CP   0FFH   ; END OF STRG
7009  20 13                   00220         JR   NZ,B11 ; GO SUB
700B  7C                      00230         LD   A,H    ; HI DIGIT
700C  FE FF                   00240         CP   0FFH   ; FIRST TIME 48K
700E  20 00                   00250         JR   Z,B10  ; YES, GO
7010  FE BF                   00260         CP   0BFH   ; FIRST TIME 32K
7012  20 04                   00270         JR   Z,B10  ; YES, GO
7014  FE 7F                   00280         CP   07FH   ; FIRST TIME 16K
7016  20 06                   00290         JR   NZ,B11 ; GO SUB
7018  01 0040                 00300   B10:  LD   BC,40H ; 64 BYTES
701B  CD 700A                 00310         CALL DSU   ; GO SUBTRACT
701E  01 001A                 00320   B11:  LD   BC,LTH ; LTH OF CODE
7021  CD 708A                 00338         CALL DSU   ; GO SUBTRACT
```

Program continued

```
7024    22 4049              00340        LD   (STRG),HL ; NEW HI STRG
                             00350  ; MUST FIND RELO FACTOR
7027    23                   00360        INC  HL    ; POINT TO SUB AREA
7028    01 70AB              00370        LD   BC,COD ; WHRE CODE IS
702B    CD 700A              00380        CALL DSU  ; RELO FACTOR
702E    44                   00390        LD   B,H   ; SAVE RELO
702F    4D                   00400        LD   C,L   ; IN BC
                             00410  ; RELOCATE NEEDED ADDRESSES
7030    DD 21 7099           00420        LD   IX,RTB ; RELO TBL
7034    DD 6E 00             00430  B40:  LD   L,(IX) ; GET LOW
7037    DD 66 01             00440        LD   H,(IX+1) ; HI BYTE
703A    22 709F              00450        LD   (WRK),HL ; SV TBL NTRY
703D    7D                   00460        LD   A,L   ; SEE IF AT
703E    B4                   00470        OR   H     ; END TABLE
703F    CA 7056              00480        JP   Z,B45  ; YES, BR
7042    5E                   00490        LD   E,(BL) ; ADR TO
7043    23                   00500        INC  HL    ;  BE
7044    56                   00510        LD   D,(BL) ; RELOC'TD
7045    62                   00520        LD   H,D   ; MOVE TO
7046    6B                   00530        LD   L,E   ; CALC REGS
7047    09                   00540        ADD  HL,BC  ; RELOCATE
7048    54                   00550        LD   D,H   ; OUT OF
7049    5D                   00560        LD   E,L   ; CALC REGS
704A    2A 709F              00570        LD   HL,(WRK) ; TBL ENT ADR
704D    73                   00580        LD   (HL),E; SAVE THE
704E    23                   00590        INC  HL    ; MODIFIED
704F    72                   00600        LD   (HL),D ; ADDRESS.
7050    DD 23                00610        INC  IX    ; POINT TO
7052    DD 23                00620        INC  IX    ; NEXT ENTRY
7054    18 DE                00630        JR   B40   ; LOOP TIL END
7056                         00640  B45  EQU  $
                             00650  ; MOVE RES CODE TO HI CORE
7056    ED 5B 4049           00660        LD   DE,(STRG) ; HI STORE
705A    13                   00670        INC  DE   ; +1 = DEST.
705B    21 70AB              00680        LD   HL,COD ; WHERE IT IS
705E    01 001A              00690        LD   BC,LTH ; LTH OF CODE
7061    ED B0                00700        LDIR ; MOVE TO HI STORAGE
                             00710  ; INIT RS-232 INTERFACE
7063    D3 E0                00720        OUT  (RESU),A ; RESET UART
7065    DB E9                00730        IN   A,(SWIT) ; READ SWTCH
7067    E6 F8                00740        AND  0F8H  ; OFF LOW 3
7069    F6 04                00750        OR   04H ; FIX LATCH
706B    D3 EA                00760        OUT  (CNTR),A ; UART CTL
706D    DB E9                00770        IN   A,(SWIT) ; READ SWTCH
706F    E6 07                00780        AND  07H ; OFF TOP 5
7071    21 7091              00790        LD   HL,TAB ; BAUD TABL
7074    06 00                00800        LD   B,00H ; CLEAR
7076    4F                   00810        LD   C,A ; OFFSET
7077    09                   00820        ADD  HL,BC ; ADD OFFSET
7078    7E                   00830        LD   A,(HL) ; GET RESULT
7079    D3 E9                00840        OUT  (SWIT),A ; LOAD BRG
                             00850  ; STUFF SUB ADR TO CTL BLK
707B    2A 4049              00860        LD   HL,(STRG) ; END STRGE
707E    23                   00870        INC  HL   ; +1=SUB ADR
707F    22 4026              00880        LD   (DVCB+1),HL ; SUB
7082    3E 02                00890        LD   A,2 ; DVC TYPE
7084    32 4025              00900        LD   (DVCB),A ; TO BLK
                             00910  ; RETURN TO TRSDOS
7087    C3 402D              00920        JP   TRSD ; ALL DONE
                             00930  ; THIS SUB DOES DBL SUB
                             00940  ; HL=HL-BC
708A    7D                   00950  DSU:  LD   A,L  ; LOW DIGIT
708B    91                   00960        SUB  C    ; GET DIF
708C    6F                   00970        LD   L,A  ; SAVE LOW
708D    7C                   00980        LD   A,H  ; HI DIGIT
708E    98                   00990        SBC  A,B  ; DIF W/CARRY
708F    67                   01000        LD   H,A  ; SAVE HI
7090    C9                   01010        RET  ; TO CALLER
                             01020  ; BAUD RATE SEL TABLE
7091    22                   01030  TAB:  DB   022H ; 110 BAUD
7092    44                   01040        DB   044H ; 150 BAUD
7093    55                   01050        DB   055H ; 300 BAUD
7094    66                   01060        DB   066H ; 600 BAUD
7095    77                   01070        DB   077H ; 1200 BAUD
7096    AA                   01080        DB   0AAH ; 2400 BAUD
7097    CC                   01090        DB   0CCH ; 4800 BAUD
7098    EE                   01100        DB   0EEH ; 9600 BAUD
                             01110  ; ADDR RELO TABLE
7099                         01120  RTB  EQU  $
7099    70B0                 01130        DW   JP1+1 ; FIELD TO RELO
709B    70B7                 01140        DW   JP2+1 ; ANOTHER...
```

Program continued

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```
709D    0000                01150         DW   0      ; END TABLE
709F    0000                01160   WRK:  DW   0      ; WORK AREA
                            01170   ; STACK AREA
70A1                        01180         DS   10
70AB                        01190   STK   EQU  $
                            01200   ; THIS PART OF CODE IS
                            01210   ; MOVED TO HI STORAGE
70AB                        01220   COD   EQU  $ ; START OF CODE
70AB    DB EA               01230         IN   A,(CNTR) ; STAT
70AD    CB 77               01240         BIT  6,A ; OF UART
70AF    CA 70AB             01250   JP1:  JP   Z,COD ; IF BUSY
70B2    DB E0               01260   CD2:  IN   A,(RESU) ; MODM
70B4    CB 77               01270         BIT  6,A ; STATUS
70B6    CA 70B2             01280   JP2:  JP   Z,CD2 ; BUSY
70B9    79                  01290         LD   A,C ; CHAR
70BA    D3 EB               01300         OUT  (DTAR),A ; SND
70BC    FE 0D               01310         CP   0DH ; CRG RTN
70BE    20 04               01320         JR   NZ,DNE ; END
70C0    0E 0A               01330         LD   C,0AH ; LINE FD
70C2    10 E7               01340         JR   COD ; SEND IT
70C4    C9                  01350   DNE:  RET  ; BACK TO CALLER
70C5                        01360   CEN   EQU  $ ; END OF CODE
001A                        01370   LTH   EQU  CEN-COD ; LTH
                            01380         END  BGN
```

Program Listing 2.

(360-400), addresses are relocated (420-640), and the resident code is moved to high storage (660-700).

The TRSDOS print driver control block is plugged to point to the new routine (860-900). Additional code initializes the UART registers from the RS-232 board switches, to set the baud rate and configuration options (720-840).

The setup and initielization code, which is executed only once and not required for operation, is not retained in storage. This aids the small storege user as only 26 bytes ere resident!

Additional resident code mey, of course, be edded to do case translation, spooling, or whatever, but remember to include necessary addresses in the table for relocation.

Address relocation can be avoided in this routine by replacing the two JP instructions with JR instructions.

You mey loed additional routines using this method without worrying about sharing the same area. The 64 bytes is skipped only by the first routine loaded.

If you don't own en assembler, use TRSDOS DEBUG to put the code in storage then key the command:

```
DUMP PRTDV/CMD (START = X'7000',
END = X'70C4',TRA = X'7000')
```

to put it on disk. This essembler presents constants in reverse backwerd notetion (high-order byte first), although they are generated low-order byte first, so use caution in entering the hex code.

Finally, to avoid memory problems (yours, not the computer's) specify AUTO PRTDV to loed the routine when TRSDOS is loaded. ■

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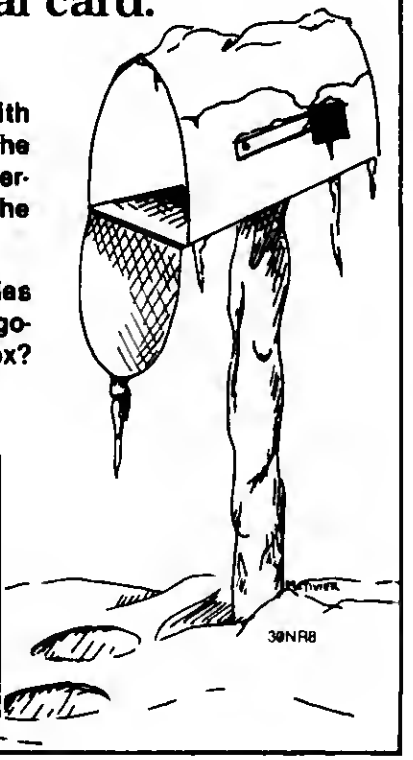

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The nicest thing about Scelbi's Personal Information Management System (PIMS) is that it can be used and modified even by beginning BASIC programmers. It's an easy means of setting up quick-and-dirty data files when there's no time to write a custom program.

Judging from the number of articles that have appeared showing how to adapt PIMS to Disk BASIC, (see *80 Microcomputing*, Feb. 1980 "Floppy PIMS"), many users seem to have found the program a handy way to ease into the mysteries of sequential disk files.

In my own household, we still turn to PIMS from time to time. My kids faithfully enter each new comic book purchase into their respective files and tote printouts of their acquisitions to comic conventions and trading sessions. I keep track of extensive book and record collections using PIMS.

I manage to keep PIMS and all the different files on a single disk, but find that it's difficult to remember the file names of the many PIMS files I maintain. What the program really needs is a directory, and I hit upon two different ways of adding this feature.

Modified PIMS

The following assumes that you have already modified PIMS for sequential disk files. The changes are simple. OPEN and CLOSE statements for input and output must be added and buffers assigned to F$, the string variable that stores the name of the file being input or output. Some PRINT #-1 and INPUT #-1 statements need to have the hyphen removed. That's about it.

Adding a directory is simple for NEWDOS+ users. Just change line 160 in PIMS to read:

```
160 ON WM% GOTO 170,10000
```

and add the subroutine shown in Program Listing 1. At that point, the program requests a CMD DIR, and displays the entire disk directory of visible files. If only PIMS data is kept on the disk, then just PIMS itself and its data files will be displayed. The subroutine asks for the file name of the desired PIMS file, then sends control back to the main program at line 1914.

Users of TRSDOS 2.3 or other systems not allowing a directory read without exiting BASIC can still add the feature to their PIMS. This subroutine is a little longer.

Program Listing 2 shows the few changes needed to PIMS itself. Line 130 changes option number two, load from cassette to load from disk, and adds a third choice, update index.

Choosing either of the latter two choices sends the control to the subroutine at 10000, but the (load from disk) option sets the value of variable FLAG to 1.

Lines 10000-10100 is an input routine that lets the user decide whether to add a file name to an existing index, or create an entirely new one. Remember, if you create a new index, the existing one will be overwritten. The create index option should be reserved for initializing a new PIMS disk or starting over with a new directory.

Lines 10105-10170 read the existing index, either for update or display. If FLAG = 1 (indicating that the user is accessing a file), the update portion of the subroutine is skipped.

The array IN$(n), read from the disk file PIMINDEX, if it exists, is added to in lines 10180 = 10320. If the index is just being created, N is incremented from one. Otherwise, the next file name added is placed in the array after the last one in the existing index. The lengthened sequential file is saved to disk.

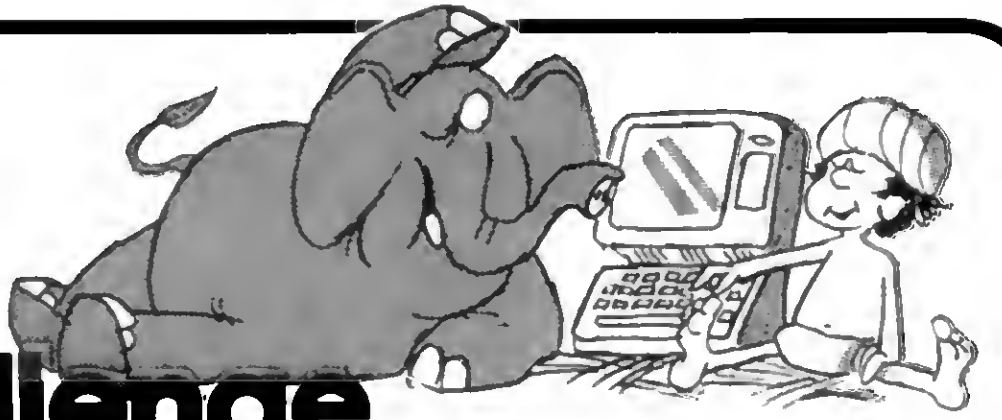
Finally, lines 10410-11030 format and display the file names on the screen in two columns. The user supplies the file name of the PIMS data file desired, that string is assigned to F$, and the program branches back to the main program at line 1914.

Suggested Modifications:

The array IN$(n) is shown on line 10010 for clarity; it can be moved to the beginning of the program with the other DIM statements. The user can make this array larger. However, TRSDOS 2.3 will only allow 47 files per disk.

It is probably best to have a separate PIMINDEX for each disk that your PIMS inhabits. That eliminates loading a file that is located on another disk

the kim challenge



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by misteke.

However, it is e simple step to write e program that reads in the PIMINDEX from e number of diske end sorts them for e Master Index or formats them for output to a printer.

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```
10000 CMD"DIR
10010 PRINT
10020 INPUT "ENTEN FILE OESIRED : ";F$
10030 GOTO 1914
```

Program Listing 1.

```
130 PRINT " 1.) CREATE NEW FILE    2.)  LOAD FROM DISK
      3.) UPDATE INDEX"
140 IF WN%= 2 THEN FLAG=1
152 ON WN% GOTO 170,10000,10000
```

Program Listing 2.

```
10000 '************************************
10005 '              CREATES, UPDATES INDEX LIST
10006 '
10010 DIM IN$(30):' ALLOWS 30 FILE NAMES. USER MAY
10011 '             INCREASE,OR MOVE TO BEGINNING
10013 '             OF PROGRAM
10014 '
10020 CLS:PRINT:PRINT
10030 R=1
10040 PRINT "DO YOU WISH TO :"
10050 PRINT "       1.) ADO FILE NAME  TO INDEX"
10060 PRINT "       2.) CREATE NEW INDEX"
10070 A$=INKEY$:IF A$="" GOTO 10070
10080 AN=VAL(A$)
10090 IF AN>2 OR AN<1 GOTO 10070
10100 IF AN=2 GOTO 10150
10105 '************************************
10106 'READS EXISTING INDEX, EITHER FOR UPDATE OR DISPL
    AY
10107 '
10110 OPEN "I",1,"PIMINDEX"
10120 INPUT #1,IN$(R)
10150 IF IN$(N)="EOF" THEN N=N-1:GOTO 10170
10160 N=N+1:GOTO 10120
10170 CLOSE
10180 CLS:PRINT:PRINT
10185 IF FLAG=1 GOTO 11000:' SKIP UPDATING AND DISPLAY
    INDEX
10190 N=N+1
10195 '****************************************
10196 '          ADO NEN FILE NAMES TO INDEX
10197 '
10200 PRINT "ENTER FILE NAME TO BE ADDED TO INDEX"
10210 INPUT "WHEN ALL NEN FILE NAMES HAVE BEEN ADDED, E
    NTER '999'";A$
10220 IN$(N)=A$
10230 IF VAL(A$)=999 GOTO 10250
10240 GOTO 10150
10250 OPEN "O",1,"PIMINDEX"
10260 FOR I=1 TO N
10270 IF IN$(I)="999" GOTO 10310
10280 PRINT #1,IN$(I);",";
10290 PRINT IN$(I)
10300 NEXT I
10310 PRINT #1,"EOF"
10320 CLOSE1
10400 '****************************************
10410 ' LIST FILE NAMES
10412 '
11000 PRINT "THE FOLLOWING FILES ARE AVAILABLE :"
11010 FOR I=2 TO N-1  STEP 2
11020 PRINT IN$(I),IN$(I+1)
11030 NEXT I
11060 PRINT
11950 INPUT "ENTER FILE OESIRED : ";F$
11960 GOTO 1914
```

Program Listing 3.

TRS-80

BASIC PLUS

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The following **BASIC PROGRAM,** written on the TRS-80, was compiled using MICROSOFT'S BASIC COMPILER and SIMUTEK'S BASIC COMPILER. *We feel the results speak for themselves!*

```
10 '  SPEED TEST
   SIMUTEK ZBASIC COMPILER VS. MICROSOFT COMPILER
15 CLS:PRINT@0,"HIT A KEY WHEN READY TO START TEST";
20 I$=INKEY$:IFI$=""THEN20ELSEFORZ=1TO10:
FORX=1536TO16383:POKEX,191:PRINTPEEK(X);:NEXTX
30 FORX=0TO127:FORY=0TO47:SET(X,Y):NEXTY,X
:FORX=127TO0STEP-1:FORY=47TO0STEP-1:RESET(X,Y)
:NEXTY,X:FORX=1TO1000:GOSUB1000:NEXTX,Z
40 CLS:PRINT"FINISHED WITH PROGRAM TEST";:STOP
1000 RETURN
```

BASIC PROGRAM SIZE: 328 BYTES
PROGRAM RUN: 22 Minutes, 37 Seconds

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DATA	READ	RESTORE	END	GOTO	GOSUB	CLS	ON GOSUB
INPUT	INKEY$	LET	STOP	OUT	INP	RETURN	ON GOSUB
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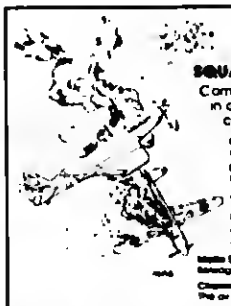

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Radio Shack gives the relay some protection with two 75 volt zener diodes across the contacts, but this isn't always enough. The relay sometimes welds shut.

When this happens, you can remove the remote plug from the recorder and operate it manually. Eventually, the relay unsticks. Or you can try the snooper/snubber.

Easy to Build

The snooper/snubber, a small easy-to-build electronic circuit, monitors the TRS-80's cassette interface and gives the relay extra protection. The snubber circuit (Fig. 1) gives the motor current some place to go when the relay contacts open, so that the current doesn't try to jump across the contacts and weld them together.

The snubber can be placed anywhere between the relay contacts and the cassette recorder motor. To avoid breaking any of Radio Shack's seals, I put the snubber circuit in a small box, plug the remote from the TRS-80 into the box, and run a jumper cable with subminiature phone plugs from the box to the recorder.

In addition, a push-button switch across the circuit lets me advance the tape in play mode.

The snooper (Fig. 2) is a simple means of monitoring the audio signals into and out of the TRS-80. The snooper consists of five miniature phone jacks, a crystal earphone, a double-pole double-throw (DPDT) center off-switch and some shielded cable.

Two of the jacks accept the earphone and auxiliary plugs from the TRS-80. Two others pass out the same signals to the cassette recorder via jumper cables with miniature plugs on each end.

The fifth jack passes one of the two signals to an external device, such as an amplifier. You'll need one, if you are running programs that produce sound.

The DPDT switch determines which of the two signals—the earphone signal (to the TRS-80) or the auxiliary signal (from the TRS-80) is passed to the fifth jack and to the crystal earphone. The crystal earphone outputs a low-volume signal, audible, but not loud enough to require a volume control.

When you record a tape, the volume level may be slightly greater, if you listen to the earphone line. If so, it is because your recorder sends out an amplified version of the input on the earphone line while recording.

Construction

If you have some experience in electronics, you can build the snooper/snubber from the schematic diagrams. If not, I've provided some guidelines.

Build your snooper snubber in a plastic box. If it's metal, you may encounter ground loops. These cause a loud, low-pitched buzz on recorded tapes. A box about 2 x 3 x 4 inches is a good size. You can use one half this size, but unless you like repairing watches or constructing ships in bottles, it's likely to prove frustrating.

You can lay out the components any way you like. Mine has the jacks for the TRS-80's cable in front, the jacks for the jumper cables in back, the fifth jack on one side and the two switches and earphone on top.

Drill the holes and mount the components loosely. (Miniature jacks take ¼-inch holes and subminiature jacks take 3/16-inch holes.) How you mount the earphone depends on its shape. If the earphone is flat, drill several small holes and glue the earphone behind them. If the earphone has a roughly cylindrical earplug, drill a hole to fit the earplug and glue the earplug to the box.

Take the shielded wire and

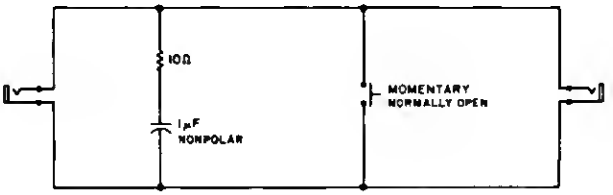

Fig. 1. The Snubber Circuit.

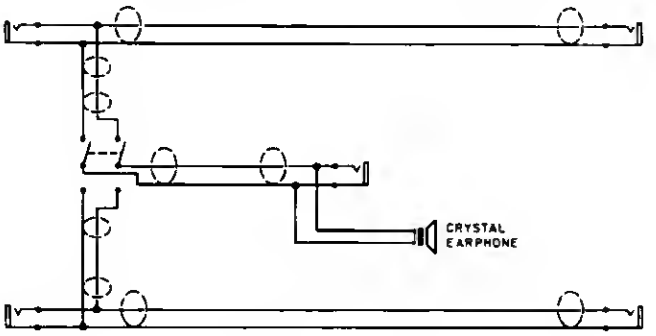

Fig. 2. The Snooper Circuit.

run it between the jacks and switches to measure how much is needed. Leave an extra inch and a half on one end of each piece of wire as it is cut. This may seem like a lot, but it is much better to stuff any extra length of wire into the box than to come up a tenth of an inch short.

Before you solder the circuit together, remove all the components from the box and put it well away from your soldering iron. The affinity that plastic boxes have for hot soldering irons, you cannot believe.

Soldering

The wiring is straightforward, but most of the parts, especially the jacks, are fairly small. You aren't going to get all the wires from the shield through those little holes in the jacks. Cut off about half of the wires very close to the insulation and things will go much easier.

Make sure that all the remaining strands of the shield are twisted together. One tiny, almost invisible strand of wire can short out one of the signals. This condition is not likely to damage anything, but the time spent trying to track down a short can be frustrating.

The DPDT switch (Fig. 3) has a 3×2 array of contacts on the bottom. All the shields should be connected to one set of three contacts, and all of the center wires to the other set of three contacts.

The shielded wires can be run from one jack to the other and then to the switch, or from one jack to the switch and then to the other. I recommend the second approach, since it puts the point where the two shielded wires join at the switch, which usually has larger contacts than the jacks.

The specific values given for the resistor and capacitor are not critical. Anything within a factor of about three should work fine. That is, the capacitor should be between about 0.3 microfarads (uF) and 3 uF, and the resistor should be between about 3 Ohms (Ω) and 30Ω. The capacitor and resistor are soldered together by one lead and soldered to the normally open push-button switch by the other (Fig. 4).

The earphone should be a high impedance type. A crystal earphone is specified, but any type with an impedance of 10KΩ (10 kilohms = 10,000 Ohms) or more will work. The high impedance minimizes loading and results in a fairly low volume.

```
10 OUT 255,4
20 FOR I = 1 TO 1000: NEXT I
30 OUT 255,0
40 FOR I = 1 TO 1000: NEXT I
50 GOTO 10
```

Listing 1. Test program.

Once you have the snooper/snubber assembled, normal use of the cassette recorder will test it. If you would like to give the snubber a thorough test, run the program shown in Listing 1. It will turn the cassette motor on and off once within a period of about five seconds. I ran this program for more than 1000 cycles of the relay with no trouble. Not bad considering that the relay had failed the first day I used my TRS-80. ■

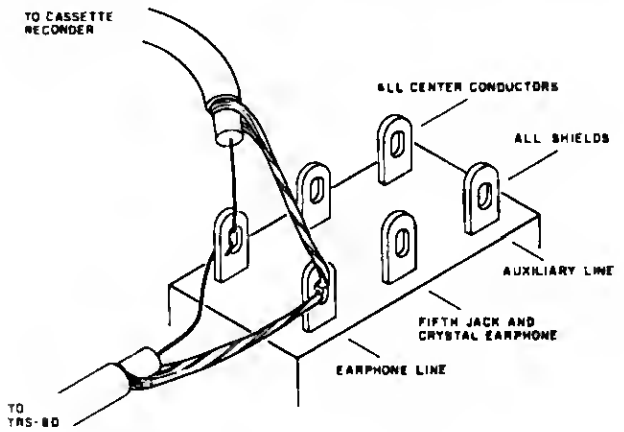

Fig. 3. The DPDT Switch.

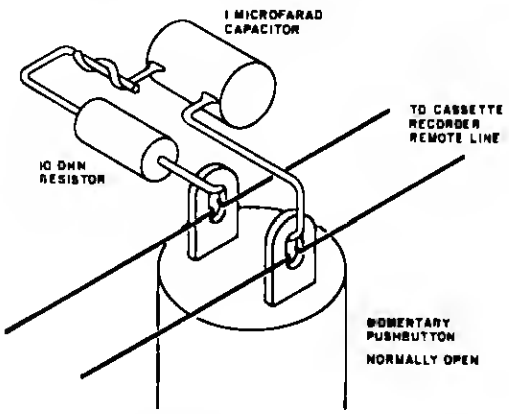

Fig. 4. The Capacitor and Resistor.

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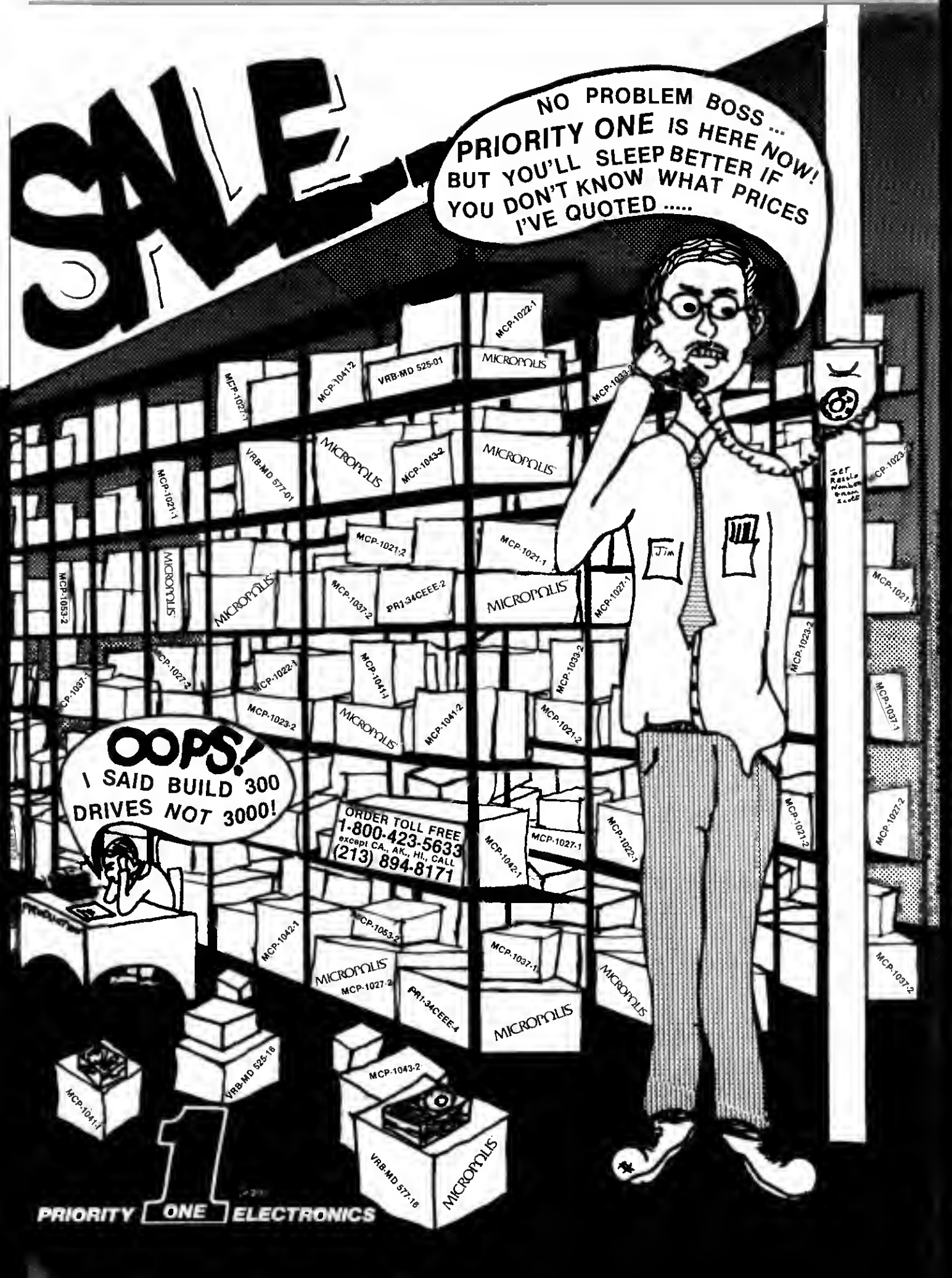
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A radial line drawing program for art's sake.

Images

Buzz Gorsky K8BG
2449 Derbyshire Road
Cleveland, OH 44106

In the past I've written some application and utility programs for *80 Microcomputing*, but this article is *useless*!

A Series of Lines

The program shown in the listing generates a series of lines like the spokes of a wheel from a randomly chosen point on the screen. It will then draw another pattern, delay, then clear the screen and start again. Let's see how it's done.

Starting at line 100 the K loop goes from one to two to draw the two patterns. X1 and Y1 are chosen randomly as values up to 127 and 47, respectively, so that the pair (X1,Y1) points to a random point on the display in the format used by SET statements. This point will be the center for the radiating line pattern.

Then, in line 110, T runs from zero to 170 drawn in increments of 10. T represents the angle in degrees (in this case 10) at which each line drawn will radiate. Since each line will run through the center of the circle, we only have to let T go this far.

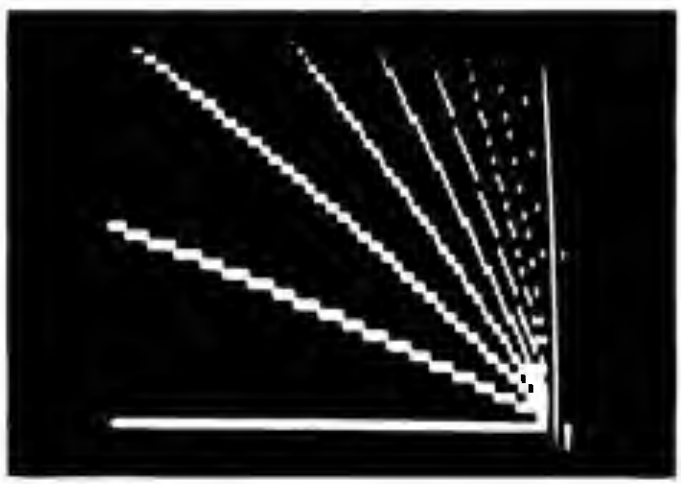
When T is 90, a vertical line is needed. This is drawn by the FOR-NEXT loop involving L. In line 120, T1 is set equal to T times a constant to change the degree value to a radian value.

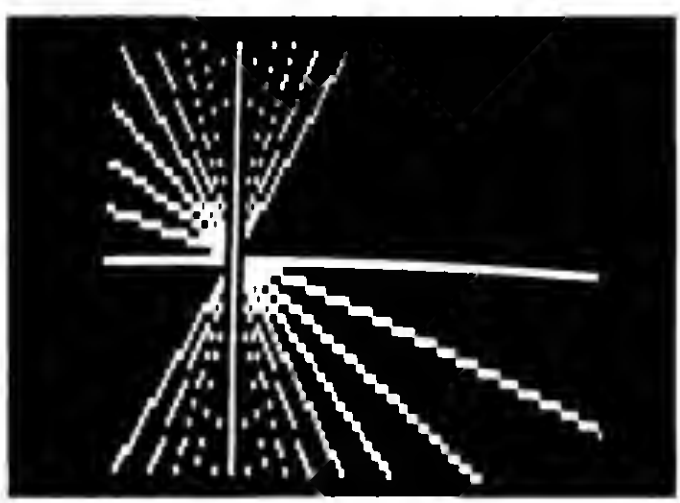
In line 130 X will run through the limits of the values which can be displayed. Y is then set equal to X times the tangent of T1. $Y = X \cdot \mathrm{Tan}(\theta)$ is the equation for a line in a polar coordinate system.

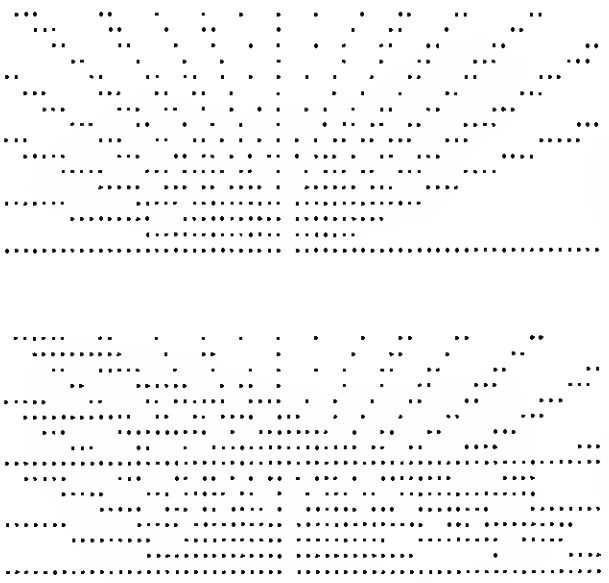
Then in 150, X2 is set equal to X + X1 and Y2 = Y + Y1. This moves the point (X,Y) from the origin of the plot (the upper left of the screen) by an amount determined by X1 and Y1.

In line 160 we check to see if the values of X2 and Y2 can be shown on the screen with a SET (X2,Y2) statement. If so, they are displayed at 170, and if not we go to 180. There we set X2 = X1 − X and Y2 = Y1 + Y. This then reflects the line just drawn through the center of the circle.

If the values of X2 and Y2 can be displayed, then the SET







Sample Patterns of Radial Drawing

statement displays them. Otherwise what happens depends on the value of Z.

If the first half of the line had terminated because values were off the screen, then Z would equal one. If this part of the line were also off limits, then we would reset Z equal to 0 and go to the next value of T. However, if Z were zero, then we would go to 190 and the next value of X. When X was completed we'd have the next value of T. In this way each half of the line is finished until it reaches the limits of the display.

In line 200 there is a short wait and then the second pattern is drawn by going to the next value of K. A long delay follows after which the program is run.

It's useless, I know, but fun to watch, and the radial line drawing technique might even find a place in something useful! ■

```
 80 REM RADIAL LINE DRAWING PROGRAM BY BUZZ GORSKY, K0BC
 90 REM THIS PROGRAM WILL BEGIN AT A RANDOM SPOT ON THE
     SCREEN AND DRAW A SERIES OF RADIAL LINES FROM THAT
      POINT.  IT WILL REPEAT THE PROCESS TWO TIMES, HOL
     D THE DISPLAY AND THEN BEGIN AGAIN
100 RANDOM:CLS:FOR K=1TO 2:X1=RND(127):Y1=RND(47):REM X
      SETS THE LIMIT OF 2 DISPLAYS BEFORE RESTARTING; X
     1 AND Y1 ARE RANDOM DISPLACEMENTS FROM THE UPPER L
     EFT CORNER OF THE SCREEN
110 FOR T=0 TO 170 STEP 10:IF T=90  THEN FOR L=8 TO 47:
     SET(X1,L):NEXT L:NEXT T:REM T IS RADIAL ANGLE IN D
     EGREES.  FOR T=90 A VERTICAL LINE IS DRAWN RATHER
     THAN USING THE Y=X*TAN(T) EQUATION
120 T1=T*3.8174533:REM MODIFY T TO RADIANS
130 FOR X=3 TO 127:REM RUNS X THROUGH LIMITS OF DISPLAY
140 Y=X*TAN(T1):REM SET Y ACCORDING TO RADIAL EQUATION
     OF STRAIGHT LINE
150 X2=INT(X+X1):Y2=INT(Y+Y1):REM MODIFY X AND Y ACCORD
     ING TO RANDOM DISPLACEMENT
160 IF (X2>127 OR Y2<0 OR Y2>47) THEN Z=1:GOTO180:REM I
     F X2 OR Y2 ARE OUT OF DISPLAY LIMITS THEN SET Z=1
     AND GO TO 180 OTHERWISE DISPLAY
170 SET(X2,Y2)
180 X2=INT(X1-X):Y2=INT(Y1-Y):IF(X2>-1 AND X2<128 AND Y
     2>-1 AND Y2<48) THEN SET(X2,Y2) ELSE IF Z=1 THEN Z
     =0:NEXT T:REM CONTINUE THE RADIAL LINE IN A MIRROR
      IMAGE.  IF X2 OR Y2 ARE OUT OF DISPLAY LIMITS AND
     Z=1 THEN GOTO NEXT ANGLE, BUT IF Z=0 THEN NEXT X
190 Z=0:NEXT:NEXT:REM RESET Z AND CONTINUE
200 FOR J=1TO500:NEXT:NEXT:FOR J=1TO3000:NEXT:RUN:REM
     DELAY THEN DRAW NEXT PICTURE, AFTER 2 PIX THEN HOL
     D THEN START AGAIN
```

Program Listing

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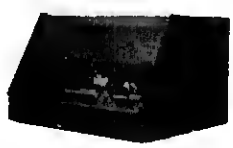

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A logical approach to graphics.

Inside-Out Debugging

Del Ogren
565 B Lynn Ct.
Glendale Hts., IL 60137

A friend of mine has the best standerd answer to the standard question posed to all new micro owners. When asked, "What are you gonna do with it?" he replies, "Make it teach me to use it." My purpose in writing this article is to attempt to make the process of learning to use a computer more enjoyable.

Specifically, I want to discuss graphics programming techniques for Level II BASIC. I'll develop a simple game program to illustrate some of the techniques presented.

Programming Style

Unfortunately, a machine has yet to be designed that translates ideas directly into computer code. This means that the user must do the translating. Learning to program is a process in which the programmer develops rituals, based on experience gained through dialog with the machine. As the error messages become less frequent, a programmer develops a style of going about the task of telling his machine what to do.

By "talking to computers," I have fallen into using what is sometimes called the "inside-out" style of programming. This style is made up of bits and pieces of "structured," "top-down" and "modular" programming and seems well suited to recreational programming.

Inside-out Programming

Inside-out programming divides a program into two major sections, a control section and a routine section. The routine section is a list of subroutines which make up the body of the program. The control section is generally a loop which calls the relevant subroutines in sequence. As ideas come to mind, a subroutine or two is added to the routine section and patched into the control section by adding GOSUB.

Say, for example, we want to create a space war game. First, we need space ships. We would write subroutines to draw them on the screen, and try them out by putting GOSUBs in the control section. We can then add animation, laser fire, photon torpedoes, fuel allocations, etc., patching in each new idea as it is developed.

As each routine is linked to the system, it can be run. Thus errors are quickly detected and easily resolved. Part of the programming burden is transferred to the computer and the whole development process takes place as a dialog with the machine.

Here are some techniques which should help you to think inside-out:

I generally leave the first 1000 lines or so for the control portion of the program and the remainder for the routines. Also, the first 1000 lines hold the housekeeping statements, starting values for variables, etc. Leaving plenty of room for expansion is important, if you are to avoid the disgusting task of re-typing large segments of code.

The most useful command in the book is GOSUB. True, it takes more memory and more time to execute than GOTO, but for program development it's the easiest way to patch in each segment as it's created. You can always go back and change the GOSUBs to GOTOs when the program is finished. (Determining when a program is finished is almost impossible—there's always just one more feature to add.)

Use comments. Here again, comments waste space but they also save a lot of development time. I begin all subroutines with a comment telling what it does, what input is required and what output comes from the routine. That way questions like, "How did I get that photon torpedo to go across the screen?" are easily answered.

If I have a subroutine that starts at 1000, my comments will be on line 998 or 999 and the calling routine will contain GOSUB 1000. That way the remarks are never executed and little run time is wasted.

When programs begin to grow, things can get out of hand. It is a good idea to keep a list of subroutine locations and important variable names as you go along. If a variable is local (only used in the subroutine), then it can be used locally in other routines, but if it is global (used throughout the program), it must be well controlled.

Once you get really wild with inside-out programming, some control sections can run as subroutines of subroutines of the control section . . . . When a program gets this far, good documentation is an absolute essential.

TRS-80 Graphics

Graphics are an important part of fun programs, so before we do some inside-out programming, let's take a look at TRS-80 graphics.

Unless you want to get involved in assembly language programming, POKE is the best command for producing graphics. SET and RESET take longer to execute and are more useful for graphing mathematical functions than for interactive interplanetary warfare.

On page D/1 in the Radio Shack Level II Manual is the memory map. You can see that the video memory, which stores the current state of the screen, is located between address 15360 and 16383 inclusive. These addresses are used in POKEing graphic symbols onto the screen.

Fig. 1 shows the beginning and ending address for each line on the monitor. Typing POKE 16320, 191, for example, will put an all white graphics character at the lower left corner of the screen.

Before you start POKEing around in memory, it's a good idea to CSAVE a backup copy of your program. If there is a not-too-well written routine in your program, it could POKE into the wrong place, bomb your BASIC interpreter and wipe out all your work.

Since there are 64 characters, or graphics blocks per line, adding 64 to the POKE address moves the image down one line on the screen, and subtracting 64 moves it up one line. Likewise, adding one to the address moves the image right, and subtracting one moves it left.

"The obvious solution is to go mosquito hunting, but, being a true computer nut, you are inspired to write a program to sharpen your swatting skills."

The Level II Manual (page C/6) gives the decimal values (just right for a POKE) of all the graphics characters. With a piece of graph paper and a bit of effort it's a simple matter to come up with all sorts of things to POKE into video memory. Fig. 3 shows some examples.

The PRINT@ statement (see Level II manual p. 3/3, and C. F. Gerald, May 79 *Kilobaud Microcomputing*) is valuable for graphics programmers. In his article Mr. Gerald includes a very useful table for determining where PRINT@ will place its characters (page 101, Fig. 2).

My favorite use of this statement has been: PRINT@ 960, "↓". The ↓ will not appear on the screen but is a line feed and will cause everything on the screen to move up one line. This can be used to move the galaxy past your spaceship in one statement.

Of course the line feed will move *everything* on the screen up so you will have to move the spaceship down to keep it in view.

INKEY$ lets BASIC read the keyboard without stopping the program and allows the user to interact with the program.

Inside-out with Graphics

Now we'll get the feel of some inside-out programming using TRS-80 graphics.

Let's say that you are sitting at the computer being pestered by a mosquito. The obvious solution is to go mosquito hunting, but, being a true computer nut, you are inspired to write a program to sharpen your swatting skills.

First, you need data to POKE into video memory so that you can create an insect. With some graph paper you discover that if 140, 157, 157 and 157 are POKEd into sequential video memory locations, a six legged critter will appear.

Once the data are generated, it is a simple matter to write a subroutine which places the bug on the screen, given some memory location at which to start POKEing.

```
999 'THIS MAKES A BUG STARTING AT
VIDEO MEMORY ADDRESS X
1000 "POKE X,140:POKE X+1, 157:POKE
X+2,157:POKE X+3,157"
1010 RETURN
```

To try out the bugmaker routine we can type:

```
10 CLS
20 PRINT@ 0, "WHERE DO YOU WANT
THE BUG? 15360-16380";X
30 CLS:GOSUB 1000
40 GOTO 20
```

When we RUN this, we can put a bug anywhere on the screen. Note that the largest number to enter should be 16380, even though the video memory goes through memory location 16383. This is to avoid

15360	15423
15424	15487
15488	15551
15552	15615
15616	15679
15680	15743
15744	15807
15608	15671
15872	15935
15936	15999
16000	16063
16064	16127
16128	16191
16192	16255
16256	16319
16320	16383

Fig. 1. Decimal addresses in video memory. Be careful not to POKE outside the upper and lower boundaries.

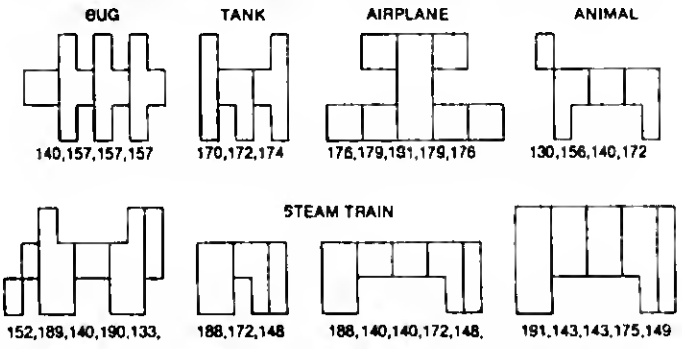

Fig. 2. Decimal data for POKEing into video memory. When generating your own images, a good rule of thumb is to make each pixel in your drawing twice as tall as it is wide.

POKEing outside the video memory—no one wants bugs in his bugmaker.

Since insects seldom show up on demand, it seems that the bug's location should be random, so we'll change line 20 to:

```
20 X = RND(1021) + 15359
```

Now X will take on a random value between 15360 and 16380. When we RUN the program the insects will appear all over the screen.

It would be nice to be able to move the critter left, right, up and down so we come up with the program in Listing 1.

Note that the routines are documented and that the first line after each comment tests to see if the insect is too near the edge of the video memory. Also note that the location of the bug is updated by each subroutine and that 128 (no pixels lighted) is POKEd into the space vacated by the moving insect. In these routines X is a global variable and Y is local.

If at this point we change line 40 and add line 50 as follows we will get a bug that moves randomly around the screen.

```
40 ON RND(4) GOSUB 1100,1200,1300,1400
50 GOTO 40
```

Now that we have created a monster it would be nice if we could have some control. Since it's no fun to stop the action for an operator INPUT, we will use INKEY$. Changing line 50 and adding lines we get:

```
50 A$ = INKEY$
60 IF A$ = "R" GOSUB 1100
70 IF A$ = "J" GOSUB 1200
80 IF A$ = "H" GOSUB 1300
90 IF A$ = "T" GOSUB 1400
100 GOTO 40
```

The insect still moves randomly, but now we can influence its position by pounding away at the keyboard, R for left, J for right, H for down and T for up. Of course, any key can be substituted (except BREAK!), but my hands seemed to fall on these keys naturally.

```
100 IF A$ = "V" GOSUB 1500:END
110 GOTO 40
```

Now we can take aim at the bug and make an attempted kill by hitting the V key. This stops the action, so that we can see if our efforts were effective in reducing the insect population.

At this point, we have everything we need for maneuvering our victim into position for the death blow, but we do not have an engine of destruction. Though it's possible to get fancy here (laser fire seems a bit much just to kill a mosquito), let's just plop down a square in the middle of the screen with the following subroutine:

```
1499 'SWAT AT SCREEN CENTER
1500 FOR Y = 15834 TO 15841
1510 POKE Y,191:POKE Y + 64,191
1520 NEXT Y
1530 RETURN
```

Patching this subroutine into the control portion of the program is possible by changing line 100 and adding 110:

Thus far our insect has been more like a crawling bug than a flying mosquito. Eliminating line 40, changing line 110 and adding 120 as follows changes the character of the game.

```
Delete line 40
110 IF RND(100)>95 GOTO 20
120 GOTO 50
```

Once this is entered and run, the insect ceases to move randomly, but each time through the control loop there is a five percent chance that the mosquito will fly off to some other location. Note what a small change is required to greatly alter the nature of the program.

Obviously, it is possible to add scoring to the "swat" subroutine, by testing the current value of X to see if the bug is in range and adding subroutines to display the number of hits and misses, along with cute phrases like "got me!"

The subroutines presented are not limited to working out your anti-insect fantasies. With some simple alterations it is possible to go after all sorts of villains: sharks, the boss, invaders from space . . . . The possibilities are endless. ■

```
1099 'THIS MOVES THE BUG LEFT. X = LOCATION, RETURNS X = X - 1
1100 IF X - 1<15360 RETURN
1110 FOR Y = X TO X + 3
1120 POKE Y - 1, PEEK(Y)
1130 NEXT Y
1140 POKE Y - 1, 128:X = X - 1:RETURN
1199 'THIS MOVES IT RIGHT. X = LOCATION, RETURNS X = X + 1
1200 IF X + 1>16380 RETURN
1210 FOR Y = X + 4 TO X + 1 STEP - 1
1220 POKE Y,PEEK(Y - 1)
1230 NEXT Y
1240 POKE Y,128:X = X + 1:RETURN
1299 'THIS MOVES IT DOWN. X = LOCATION, RETURNS X = X + 64
1300 IF X + 64>16380 RETURN
1310 FOR Y = X TO X + 3
1320 POKE Y + 64,PEEK(Y):POKE Y,128
1330 NEXT Y
1340 X = X + 64 RETURN
1399 'NOW UP  X = LOCATION, RETURNS X = X - 64
1400 IF X - 64<15360 RETURN
1410 FOR Y = X TO X + 3
1420 POKE Y - 64,PEEK(Y):POKE Y,128
1430 NEXT Y
1440 X = X - 64:RETURN
```

Program Listing 1.

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Call it what you like, this program will still read disk directories, number programs, and run them with one keystroke!

You Can Call It. . . Ray

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This program only works with NEWDOS (unless you are looking for yet another way to get into DEBUG).

I've seen a number of ads for disk menu programs, all of which require typing the program names. For this they want ten bucks?! What's the point of having a computer if you have to do all the work? And at the rate I juggle programs around on my disks that would be a lot of work.

What I really wanted was a menu program that would read the directory for me. Alas, it takes a more knowledgeable soul than I to write a program that can read a disk's directory track.

But, calling a directory and PEEKing the video screen memory locations is a roundabout way to get to the same place.

Read the Directory

DIRPICK is a BASIC program which reads the directory of the disk drive of your choice, numbers the programs, and runs any BASIC or /CMD file by entering its number.

CMD"DIR gets the directory onto the screen. As you can see in Example 1, the program titles appear at 20 character intervals across the screen. Each line is 64 characters wide.

Variable Z counts the three programs across the screen and variable Y counts lines. Since the start of the first program name is always location 15488 (3C80H), the starting location of each succeeding name (variable L) is 15488 + 64*Y + 20*Z (Line 230).

Line 260 PEEKs the screen memory and stores the characters in the A$ array. Variable C moves the PEEK to the next memory location. Variable P numbers the programs. Line 280 tests for blanks (ASCII code 32). When a blank is encountered, DIRPICK assumes that this is the end of the program name. It then jumps to Line 300, which replaces the original program name with P)PROGNAME (see Example 2), and moves on to the start of the next program name.

Line 290 tests for a null string. A null string means no more programs, so DIRPICK jumps to the program-call section (Lines 330 to the end). Lines 350 to 370 save you the trouble of hitting the enter key, if there are nine programs or less.

If you have more than thirty programs on a disk (I know it's possible, but I've got to see it to believe it!), you will have to increase the CLEAR statement in

```
5 REM  "DIRPICK" BY BARRY KORNFELD
10 CLS: PRINT "DRIVE NUMBER? (YOU DO NOT HAVE TO HIT <ENTER>)"
20 A$=INKEY$:IF A$=""GOTO20                    '*** DELETE   ***
30 PRINT:PRINT"PLEASE WAIT A MOMENT"           '*** LINES    ***
40 ON VAL(A$)+1 GOTO 50,70,90,110              '*** 10 TO    ***
50 CMD"DIR                                     '*** 170      ***
60 GOTO 295                                    '*** IF       ***
70 CMD"DIR :1                                  '*** YOU      ***
80 GOTO 280                                    '*** HAVE     ***
90 CMD"DIR :2                                  '*** A        ***
100 GOTO 280                                   '*** ONE      ***
110 CMD"DIR :3                                 '*** DRIVE    ***
120 GOTO 280                                   '*** SYSTEM   ***
130 END                                        '***************
140 '*****************************************************
150 '                    *** DELETE THIS SECTION **********
160 '                    *** IF YOU HAVE A ****************
170 '                    *** MULTI-DRIVE ******************
180 CMD"DIR"             *** SYSTEM ***********************
190 '*****************************************************
200 CLEAR500
210 DIM A$(31)                      'SETUP PROG NAME ARRAY
220 FOR Z=0TO2                      '3 PROGRAMS PER LINE
230 L=15488+64*Y+20*Z               'CALCULATE SCREEN LOCATION
                                        OF START OF PROG NAME
240 P=P+1                           'NUMBER PROGRAMS
250 C=0
260 A$(P)=A$(P)+CHR$(PEEK(L+C))    'PEEK SCREEN & STORE
                                        CHARACTERS IN ARRAY
270 C=C+1                           'MOVE TO NEXT SCREEN LOCATION
280 IF PEEK(L+C)<>32GOTO260         'LOOP IF NOT A BLANK
290 IF A$(P)=" "GOTO330             'IF NULL GOTO PROGRAM SELECT
300 PRINT@(L-15361),STR$(P);") ";A$(P);
                                        'REPRINT PROG NAME WITH P
    ROG #
310 NEXTZ                           'ACROSS SCREEN TO START OF NEXT
                                        PROG NAME
320 Y=Y+1: Z=0: GOTO 220            'DOWN TO START OF NEXT LINE
330 PRINT:PRINT
340 PRINT"PROGRAM NUMBER?  (ENTER 0 TO RESTART DIRPICK)"
350 IF P>10 GOTO 360
360 X$=INKEY$:IF X$=""GOTO 360
370 X=VAL(X$): IF X=0 GOTO10 ELSE 390
380 INPUT X: IF X=0 GOTO 10
390 IF RIGHT$(A$(X),3)="CMD"THEN CMD A$(X)ELSE RUN A$(X)
```

Program Listing. DIRPICK

```
FILE DIRECTORY -- DRIVE 1        PROGRAMS - 11/17/37

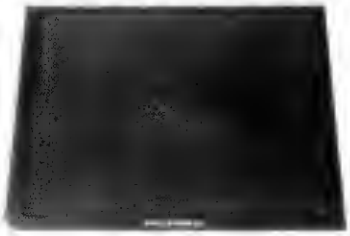
GORP/CMO          NAMEPROG/CMO      GROPE/BAS
GNOMEARP/CMO      GORNEMAP          NAME/CMO
PROGNAME/BAS      GRAMNOPE          EMAN/BAS
PROG/BAS          MEAN/CMO

DOS READY
```

Example 1.

for the TRS-80 from Micro-Mega

The Original GREEN-SCREEN



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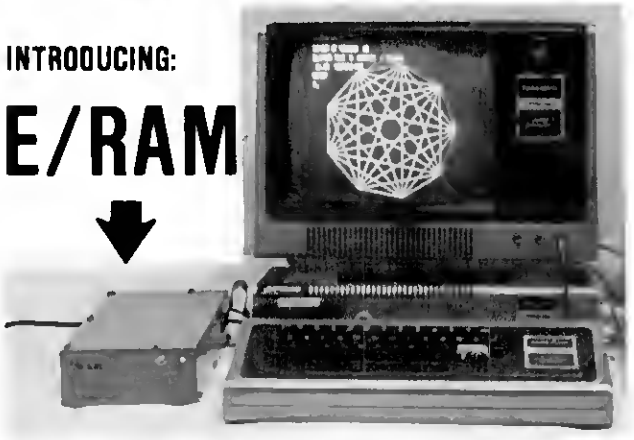

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READ	-	Reads a point from the screen
BLACK	-	Sets drawing mode to black (off)
WHITE	-	Sets drawing mode to on
CLEAR	-	Clears the high-resolution graphics screen
LINE	-	Draws a line

As an example, after the utilities package is loaded and you desire to draw a line, the following sequence of BASIC instructions could be executed.

U=USR(0)	Return the communications area
POKE U+1,X0	Provide the beginning X coordinate
POKE U+3,Y0	Provide the beginning Y coordinate
POKE U+5,X1	Provide the ending X coordinate
POKE U+7,Y1	Provide the ending Y coordinate
V=USR(4)	Draw the line (Current speed is approximately 13 vectors/second)

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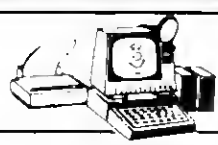

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Line 200, and the DIM statement in Line 210. Line 390 can be adjusted (with an OR or two) to run command files with other /EXTs.

If you have the Radio Shack lowercase mod, you have probably discovered that it screws up the codes stored in the video screen memory locations. The problem is that, until a lowercase driver is loaded, the ASCII codes read 64 less than they should. So PEEKing the video memory yields control codes instead of character codes. The fix for DIRPICK is:

```
260 X=PEEK(L+C): IF X<32 THEN X=X+64
265 A$(P)=A$(P)+CHR$(X)
```

This will work with correct or screwed up codes in memory.

Most of your BASIC programs can be kludged to return you to DIRPICK. Many /CMD programs will return you to BASIC leaving DIRPICK intact. Enter RUN and you're back in business. I know it works with DIRCHECK. Just think, you could run for days without having to keyboard more than a few numbers.

One colleague asked me why I didn't call it MENU since it is a menu program. The problem is that every third disk has a program called MENU, so I called it DIRPICK. But if you like, you can call it MENU . . . or you can call it Rey, or you can call it Jay . . . ■

```
FILE DIRECTORY -- DRIVE 1        PROGRAMS - 11/17/37
1) GORP/CMD          2) NAMEPROG/CMD     3) GROPE/BAS
4) GNOMEARP/CMD      5) GORNEMAP         6) NAME/CMD
7) PROGNAME/BAS      8) GRAMNOPE         9) EMAN/BAS
10) PROG/BAS         11) MEAN/CMD

PROGRAM NUMBER? (0 = RESTART DIRPICK)
?_
```

Example 2.

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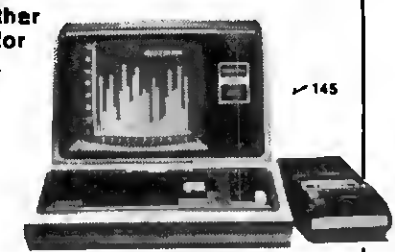

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Sound advice for 80 owners.

POW—BANG ZAP—(CRASH)

John L. Brandolini N1ABE
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Years ago, when the topic of computers came up, most people visualized a rack full of flashing lights accompanied by weird electronic sounds. With the present trend in electronics bringing computers into the home, that illusion has dissipated.

Though the visual display can be entertaining, to me it is something akin to playing pinball without the bells, thumps and buzzer.

Adding Sound

By applying techniques extracted from the TRS-80 assembly language manual and the *Level II Reference Manual*, the procedure outlined here adds sound through your 80's cassette I/O port to an external amplifier.

The program is limited only by the user's imagination. Through manipulation of frequency, tone duration and multiple tones, one can bring life to myriad game programs, or simply signal the end of a long program.

The procedure works as follows (Listing 1). A one-byte count, 0<n≤FFH (255 decimal) is POKED into memory location 7FFDH (32765 decimal) for duration and 7FFEH (32766 decimal) for frequency.

Upon call to the USR routine, the C register is loaded with the contents of the memory location specified by the index register (IX + 0). This controls the duration of the outer loop.

The B register is then loaded with the count specified by the index register (IX + 1) to control inner loop 2 (frequency). A count of one is loaded in the A register and shifted out to the cassette port (FF) for the first half of the cycle, while decrementing the B register.

When the count in the B register reaches zero, control passes to loop 3. With the B register again loaded with the frequency count, a 2 is loaded in the A register and shifted out the cassette port for the second half of the cycle.

When loop 3 falls through, the C register is decremented and the contents checked for zero. If the count is greater than zero, the program jumps to the beginning of the subroutine and the process starts over. When the C register reaches zero, loop 1 falls through and a return is made back to the BASIC program that called it.

I've included the machine language routine to illustrate the

```
                                        ;SOUND EFFCTS SUBROUTINE
                                        ;
                                        ;BY JOHN L. BRANDOLINI
                                        ;
                                        ;START OF SUBROUTINE
                        ORG     7FØØH   ;
7FØØ  DD,21,FD,7F       LD      IX,7FFDH
  Ø4  DD,4E,ØØ          LD      C,(IX+Ø)  ;GET DELAY
  Ø7  DD,46,Ø1  DELAY   LD      B,(IX+1)  ;GET TONE
  ØA  3E,Ø1             LD      A,1       ;CYCLE PORT 'FF' ON
  ØC  D3,FF             OUT     (ØFFH),A  ;
  ØE  1Ø,FE     TONEØ   DJNZ    TONEØ     ;DELAY FOR TONE
  1Ø  DD,46,Ø1          LD      B,(IX+1)  ;GET TONE
  13  3E,Ø2             LD      A,2       ;CYCLE PORT 'FF' OFF
  15  D3,FF             OUT     (ØFFH),A  ;
  17  1Ø,FE     TONE1   DJNZ    TONE1     ;DELAY FOR TONE
  19  ØD                DEC     C         ;
  1A  2Ø,EB             JR      NZ,DELAY  ;SOUND TILL DONE
  1C  C9                RET               ;GO BACK TO MAIN PROGRAM
                        END
```

Program Listing 1. Machine Language Routine.

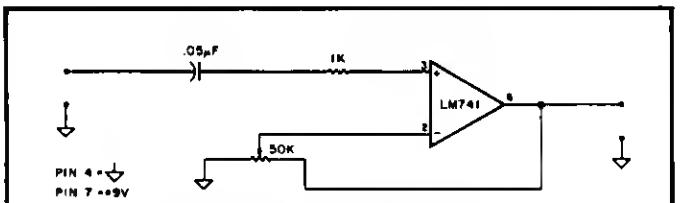
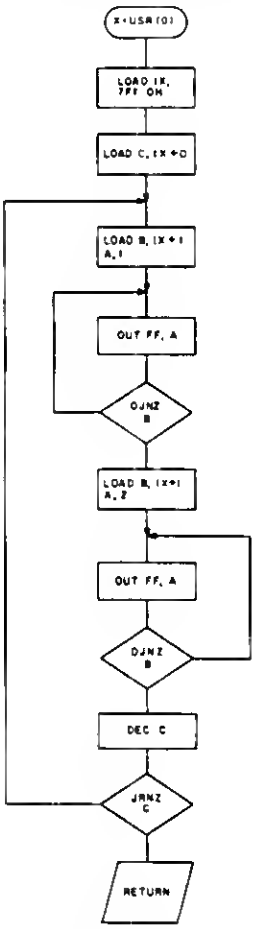


Fig. 1. Sound Amplifier Circuit.



Flow Chart

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Z-80 commands used to produce the sounds. To implement the program one uses the technique illustrated in the *Level II Reference Manual* for storing a USR routine in a string (Program Listing 2). This needs to be done only once during the program. By POKEing a count into memory locations 32765 and 32766 (0<n≤255) and calling the USR routine, one can generate tones through the cassette I/O.

The program in Listing 2 contains a demo routine in the first few lines. To use the sound routine in your program, delete up to 31999 and follow the aforementioned steps to call the routine.

If you do not have a suitable amplifier to use with the TRS-80, you could use the circuit depicted in Fig. 1.■

```
5 CLS:RANDOM:GOTO32000
15 F=RND(75)+35:D=RND(200):'PICK FREQ. & DELAY COUNTS
17 PRINTCHR$(F);CHR$(D);
40 POKE32765,D:POKE32766,F:'STORE DELAY AND FREQ. IN ME
     MORY LOC 7FFD & 7FFE
50 X=USR(0):'CALL SUBROUTINE TO CREATE TONE
75 GOTO15
31999 END
32000 DATA221,33,253,127,221,70,00,221,70,01,62,01,211,
     255,16,254,221,70,01,62,02,211,255,16,254,13,32,23
     5,201:'MACRINE LANGUAGERDUTINE FOR CREATINE OF TON
     E
32010 CLEAR100:P$="":FORI=1TO29:READJ:P$=P$+CHR$(J):NEX
     T:'ROUTINE TO PUT MACHINE LANGUAGE INTO MEMORY
32020 POKE16526,PEEK(VARPTR(P$)+1):'LOAD IN LOW BYTE OF
     START ADDRESS OF USR ROUTINE
32030 POKE16527,PEEK(VARPTR(P$)+2):'LOAD IN HIGH BYTE S
     TART     ADDRESS OF USR ROUTINE
32040 GOTO15:'RETURN TO MAIN PROGRAM AFTER LOADING IN S
     OUND SUBROUTINE
32999 END
```

Program Listing 2. BASIC Call Program.

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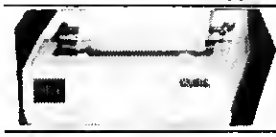

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Finally! A long overdue outline for Scripsit's six hour instruction tapes.

The Table of Contents

Dennis Thurlow
Instant Software, Inc.
Peterborough, NH 03458

Scripsit's word processing system from Radio Shack includes everything except a table of contents for its instructional tapes. Therein lies the biggest fault of the Scripsit package—a six-hour long effair—that makes review and brushup difficult.

We have, therefore, compiled a table of contents. The numbers are the tape counter numbers, including leader.

The Scripsit system supports the following modes: upper and lowercase; left and right justification; disk I/O; block moves; global commands and headers and footers on each page. The whole thing is similar to Compugraphic's software package right down to the tapes that come with it.

Here is a table:

Lesson One

000: Introduction
021: What is a Word Processor?
095: General Instructions
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371: Running the Program
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426: Enter Key
457: Control Key/Deleting Individual Characters
512: Moving the Cursor Up/More Delete Keys
576: Review/More Cursor Moves
646: A Few Words About the Buffer
650: Preparing the Printer
676: Printing the Text
691: Why the Cursor Moves After Printing
716: Power Down Procedure

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137: Finding the Number of Characters Typed
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224: Setting the Width
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575: Printing Standards, Lines, Margins, etc.
598: Changing Printout Format
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642: More Upper/Lowercase Considerations
646: More on Margins
664: Line Spacing
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247: Centering, Justifying, and Other Formats
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537: Saving Text
585: More on Header Blocks
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Lesson Four

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517: Other Ways to Save a Document
548: Four Load Instructions
565: Some More Print Instructions
587: DOS Instructions
620: Reminders on Errors

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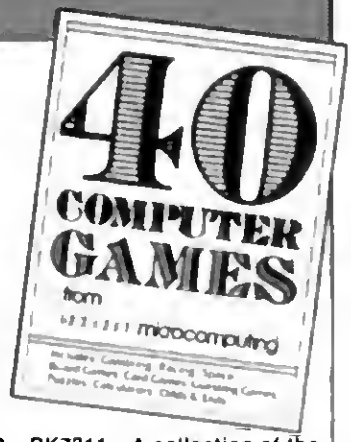

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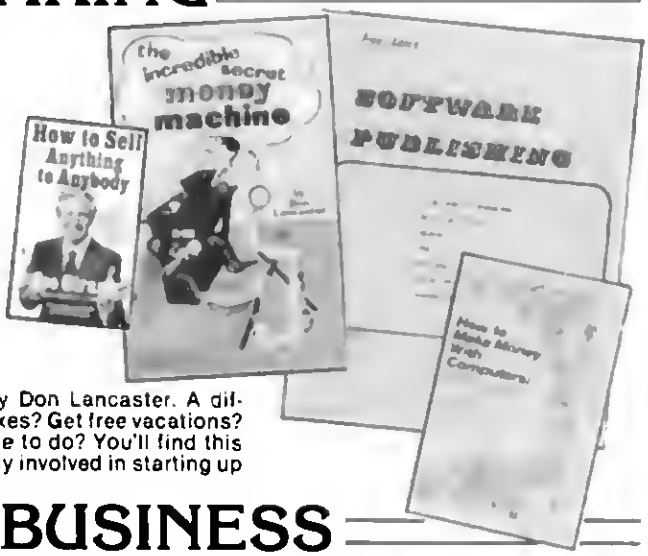

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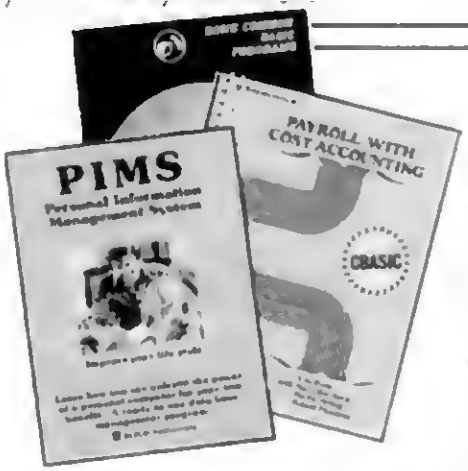

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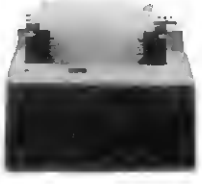

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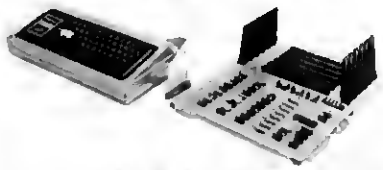

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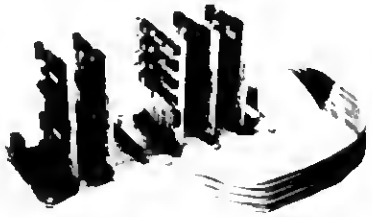

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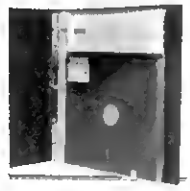

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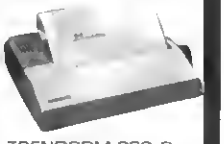

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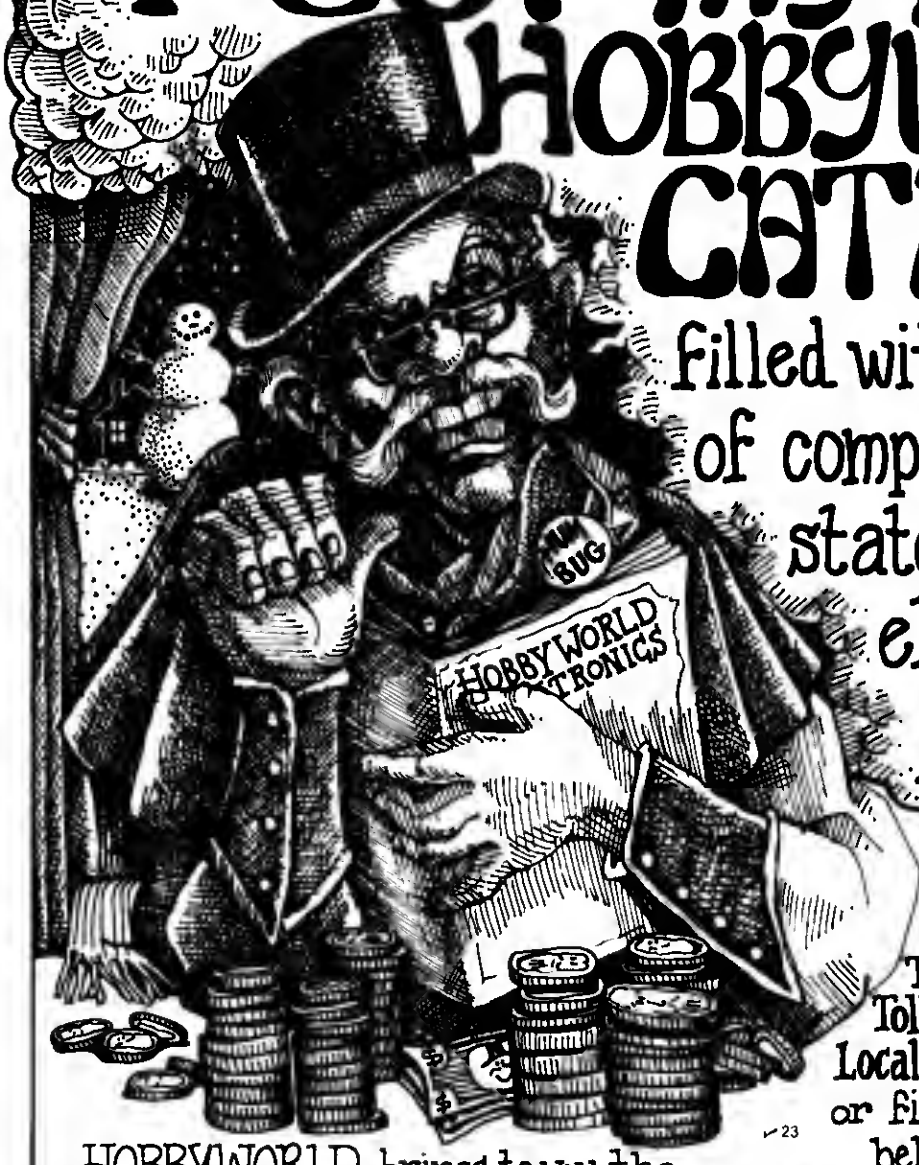

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QUOTES FROM THE June, 1980 Microcomputing article "Super Word Processors" by Rod Hallen

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